BIRLA CENTRAL LIBRARY
PILANI (Rajasthan)

Class No. 615.25

Book No. B43P

Accession No. 45629

Acc. No......................

ISSUE LABEL

Not later than the latest date stamped below.

PRACTICAL EMULSIONS

By

H. BENNETT

Technical Director, Glyco Products Company, Inc.;
Editor, *Commercial Waxes*, *Chemical and Technical Dictionary*, *Chemical Formulary*, etc.

Second, Completely Revised Edition,
Including a Symposium on *Emulsifying Agents and Emulsions in Industry*

1947
CHEMICAL PUBLISHING CO., INC.
BROOKLYN, N. Y. U.S.A.

Copyright
1947
CHEMICAL PUBLISHING CO., INC.
BROOKLYN NEW YORK

PRINTED IN U.S.A.

PREFACE TO THE SECOND EDITION

THIS second edition is a careful revision of the first edition which has been brought up to date. Additional matter on partial fatty acid esters of polyhydric alcohols has been included as well as their application in bread, cake, ice-cream, egg products, candy, etc.

Special sections have been added on the use of soap, lecithin and pectin as emulsifying agents and on surface-active germicides. A symposium on industrial emulsions has been added. This covers the use of emulsions in leather, synthetic latex, polishes, cosmetics, paints, dyeing and coloring. Lastly, newly developed emulsion formulae have been placed in the formula section.

Grateful acknowledgment is made to all those who have contributed material, advice and help, in the preparation of this edition, whose names do not appear therein, at their request.

H. BENNETT

PREFACE TO THE FIRST EDITION

THERE are many excellent books on colloid chemistry, which deal with emulsions in a theoretical and general manner, but there is none which specifically deals with emulsions for the practical worker. This book, therefore, touches only lightly the theoretical aspects and concentrates on the art of making and applying emulsions. No attempt has been made to compile a complete record, of all published work on emulsions. The aim has been to give sufficiently diverse examples to build a foundation for practical work.

Emulsions are used in many varied fields, e.g., as polishes in metal cutting, in leather processing, in textile treatment, as agricultural sprays, in food and medicinal products, and so forth.

The greatest drawback concerning emulsions is the lack of a proper understanding of the technique and formulation that is necessary to produce a good emulsion. Most formulations in this field have been obtained by "rule-of-thumb" methods; they are predicated on innumerable experiments and have withstood the test of long usage.

The purpose of this book is to set forth this practical information, within small compass, thus making it readily available to technical workers who, it is hoped, will find it helpful.

H. BENNETT

CONTENTS

CHAPTER PAGE

PREFACE TO SECOND EDITION iii

PREFACE TO FIRST EDITION v

INTRODUCTION xv

Part I. General Information

I. TYPES OF EMULSIONS 3
O/W and W/O Emulsions—Inversion—Dual Emulsions . . . .

II. EMULSIFYING AGENTS 9
Acacia Gum—Agar-agar—Bile—Carbohydrates—Cholesterol and Lanolin—Egg Yolk—Gelatin—Lecithin—Pectin—Polyhydric Alcohol Compounds—Soaps—Solid Emulsifiers—Sulfated and Sulfonated Emulsifiers—Hydrotropic Solvents . . . .

III. FOAMS AND FROTHING 21

IV. METHODS, FORMULATION, EQUIPMENT 26
Emulsification by Ultrasonic Waves—Emulsifying High-melting Materials—Formulation—Emulsifying Equipment (Mixers, Colloid Mills, Homogenizers) . . . .

V. STABILITY 42
Viscosity—Phase-volume Ratio—Creaming—Particle Size—Emulsifiers and Constituents—Temperature—Electrolytes—Causes of Instability—Testing Stability of Emulsions—Breaking Emulsions . . . .

CHAPTER PAGE
VI. GENERAL TECHNICAL EMULSIONS . . 59
Chemical Activity—Agricultural Spray Emulsions—Asphalt Emulsions—Cosmetic Emulsions—Miscible, "Soluble," or Cutting Oils—Detergent Emulsions—Food Emulsions—Lacquer Emulsions—Latex Emulsions—Leather Emulsions—Medicinal Emulsions—Paint Emulsions—Polish Emulsions—Transparent Emulsions—Wax Emulsions . . . .

VII. DISPERSING AGENTS AND WETTING AGENTS 76
Dispersing Agents—Wetting Agents—List of Commercial Surface-active Agents . . . . .

VIII. LIST OF EMULSIFYING AGENTS 85

IX. LIST OF EMULSIONS 114

X. LIST OF DEMULSIFYING AND DEFOAMING AGENTS 161

Part II. Symposium

XI. PAPERS ON EMULSIFYING AGENTS . . 167
Lecithin as an Emulsifying Agent—Pectin as an Emulsifier—Pectin Emulsions and Ointments—Polyhydric Alcohol Compounds—Soap—Surface-active Agents as Germicides . . . . .

XII. PAPERS ON EMULSIONS 202
Cosmetic Emulsions—Dye Emulsions—Emulsions in Leather Manufacturing—Emulsion Paints — Food Emulsions — Industrial Wax Emulsions—Synthetic Rubber Latex . . . .

Part III. Formulas

XIII. AGRICULTURAL SPRAY EMULSIONS . 257
Agricultural Sprays—Insecticide Sprays—Emulsifiers and Spreaders for Insecticides—Sheep Dips . . . .

CHAPTER PAGE

XIV. CUTTING OILS, "SOLUBLE" OILS, MISCIBLE OILS 272

Cutting Oils, "Soluble" Oils, Miscible Oils—Metal-drawing Compounds—Naphthenic Miscible Oils . . . .

XV. EMULSIFYING AGENTS 286

XVI. BITUMINOUS EMULSIONS 291

Asphalt Emulsions — Bitumen Emulsions — Pitch Emulsion—Tar Asphalt Emulsion . .

XVII. CLEANERS AND SOAPS 298

Dry Cleaners' Soaps—Pine Oil Soap—Emulsion Solvent Soaps—Auto Radiator Cleaner—Chromium Plate Cleaners—Graphite Cleaner—Ink Cleaner — Lacquer Remover — Greasy Leather Cleaner—Metal Cleaner—Soap Paste Paint Cleaner—Painted Woodwork Cleaner—Rug Cleaner—Upholstery Cleaner—Saddle Soap—Washing Compound—Composition to Clean Wooden Surfaces—Cleaner Emulsion for Printing Rolls—Cleaner for Rubber Rugs . . . .

XVIII. COSMETIC AND DRUG EMULSIONS . . 311

All-purpose Creams—Skin Lotions—Beauty Milk—Acid Skin Milk—Bath Milk—Bath Oil—Almond Oil Emulsion—Lanolin Emulsions—Cleansing Creams—Cold Creams—Cosmetic Creams — Perspiration-deodorizing Creams — Freckle "Preventative"—Acid Creams—Honey and Almond Type Creams—Astringent Creams—Avocado Tissue Cream—Avocado Oil Cleansing Cream—Almond Cream, Liquid—Boroglycerin Lanolin Cream—Peroxide Cream—Bleaching Cream—Cholesterol-lecithin Creams—Hormone Creams—Lime and Glycerin Cream—Absorption Bases—"Nourishing" Creams—Protective Hand Creams—Massage Cream—Sports Cream—Nail Cream—Mosquito-repelling Cream—Antiseptic Cream—Acriflavine

CHAPTER PAGE

Emulsion—White Oil Emulsion—Sunburn Preventive Preparations—Sunburn Healing Preparations—Burn Emulsions—Hair Creams—Hair Milk—Milky Hair Wash—Soapless Shampoo—Hair Tonic—Pine Oil Emulsions—Solidified Perfume—Water-soluble Perfumes—Shaving Creams—Disinfectant Emulsions—Pine Oil Disinfectant—Antiseptic Emulsion—Liquid-petrolatum Emulsion—Air-odor Neutralizer .

XIX. DEFOAMING AGENTS 367
Defoaming and Defrothing Agents . . . . .

XX. FOOD EMULSIONS 370
Butterscotch Icing—Chocolate Milk, Stabilized—Artificial Cream—Synthetic "Cream" for Confectionery—Cheese-, Ice-cream-, and Salad-stabilizer — Dairy-product-stabilizer — Infants' Milk (Synthetic)—Lemon Oil Emulsions—Transparent Lemon Oil Emulsion—Orange Oil Emulsion—Orange Emulsion (Cloudy)—Bitter Almond Oil Emulsion—Butter Substitute—Mayonnaise—Salad Dressings . . . . . .

XXI. GASOLINE EMULSIONS 381
Gasoline Emulsions—Anti-knock Fuel—Solidified Gasoline—Sound-absorbing Composition .

XXII. LACQUER EMULSIONS 388
Nitrocellulose Emulsions—Lacquer Emulsifiers—Black-pigmented Lacquer Emulsion—Gray-pigmented Lacquer Emulsion . . . . . .

XXIII. LEATHER TREATMENT EMULSIONS . . 396
Fat-liquors—Leather Dressings—Leather Finishes and Polishes—Edge-Filler for Shoe Factory Use—Softener for Leather Goods . . .

XXIV. LUBRICANT EMULSIONS 402
Lubricant Grease—"Cold Roller Grease Briquets"—Horse-shoe Grease—Mixed-base Grease

CHAPTER PAGE

—Soap-base Lubricating Emulsion—Viscous Emulsion Lubricant—Water-in-oil Emulsion Lubricant—Graphite Lubricant—Anti-corrosive Spindle Lubricant . . . .

XXV. MEDICINAL EMULSIONS 406
Burn Ointments—Cod Liver Oil Emulsions—Frost-bite Preventive Creams—Mineral Oil Emulsions—Liniments—Castor Oil Emulsions—Water-dispersible Antiseptic Oil—Antiseptic Liquid—Mercuric Nitrate Ointment—Psoriasis Lotion—Sulfanilamide Emulsion—Hay Fever Ointment—Disinfectant Emulsion . . . . .

XXVI. PAINT EMULSIONS 422
Resin Oil Emulsion—Semi-paste Paints—"Piccolyte" Oil Emulsion (V-338)—"Piccolyte" Oil Emulsion Semi-paste . . . .

XXVII. PAPER PROCESSING EMULSIONS . . . 431
Paper Sizings—Waterproofing Emulsions for Paper—Emulsion for High Luster Paper—De-inking Printed Paper . . . .

XXVIII. POLISH EMULSIONS 437
Automobile Polishes—Floor Polishes—Bright-drying (Rubless) Floor Polish Emulsions—Furniture Polishes—Leather Polishes—Black Bottom Gloss—Brown Bottom Gloss—"Natural" Bottom Finish—Pale Pink Bottom Finish—Shoe Ink—Modern Transparent Heel and Edge Finish—Dark Brown Heel and Edge Stain—"Natural Leather" Bottom Stain—Brown Bottom Finish—Light Brown Russet Finish—"Bend" Colored Bottom Finish—Wax Russet Finish (Buff)—Brown Russet Stain—"Natural Leather" Finish—White Bottom Gloss—White Bottom Cream—Brown Bottom Cream—One Setting Edge Ink—Combined Ink for Bottoms, Heels and Edges—General Ink—Polishing Ink—Quick Black—Heavy Ink for Spongy Leathers

CHAPTER PAGE
—Burnishing Ink—Gloss Ink,—White Shoe Polishes—Metal Polishes—Protective Coating for Aluminum and Other Metals—Stove Polishes—Miscellaneous Polishing Emulsions—Neatsfoot Oil Polish—Glass Polish—Oil Polish—Abrasive Polish . . . .

XXIX. RESIN AND RUBBER EMULSIONS . . 510
Rosin Emulsions—Rosin-turpentine Emulsion—Paraffin-Rosin Emulsion—Cumar Emulsion—Gelva Resin Emulsion—Pentaerythritol Abietate Emulsion—Stabelite Ester Emulsions—Ethyl Cellulose Emulsions—Methyl Methacrylate Emulsions—Natural Resin Emulsions—Cellulose Ester Emulsion—Polystyrene Resin Emulsion—Vinylite Emulsions—Rubber Emulsions—Rubber Resin Emulsion—Chlorinated Rubber Emulsions . . . .

XXX. TEXTILE EMULSIONS 523
Textile Sizings—Anti-static Textile Dressing—Kier Penetrant Oil—Luster Emulsion for Starching—Rotproofing Emulsion—Textile-scouring Assistant—Degreasing Emulsion—Soapy Fulling Oil—Textile Softeners—Textile Gloss Oil—Yarn Finish—"Soluble" Textile Oils—Textile-scouring Emulsion—Non-slippery Belt and Rope Preservative—Spinning Oil for Light or White Fibers—Rope Preservative—Textile Lubricants—Oil Coating for Glass Fibers—Acetate Rayon Oil—Waterproofing (Acetate) Rayon—Rayon Delustering—Mothproofing Emulsion . . . .

XXXI. WATERPROOFING EMULSIONS 534
Textile-waterproofing Emulsions—Waterproofing for Leather . . . .

XXXII. WAX EMULSIONS 537
Bentonite Wax Emulsions—Candelilla Wax Emulsions—Carnauba Wax Emulsions—Carn-

CHAPTER PAGE

auba-Wax-Resin Emulsions — Ceresin Wax Emulsion—Esparto Wax Emulsion—Halowax Emulsions—Japan Wax ("Soluble")—Japan Wax Emulsion — Self-emulsifying Laundry Wax—Montan Wax Emulsions—Opal Wax Emulsions—Ouricouri Wax Emulsion—Paraffin Wax Emulsions—Paraffin Wax ("Soluble") .

XXXIII. MISCELLANEOUS 550
Non-aqueous Emulsion — High-temperature-stable Non-aqueous Emulsions—Safety-paper Ink—Non-foaming Oil Emulsion—Petroleum Demulsifiers — Dichloroethyl Ether Emulsion Spray—Carbon Disulfide Emulsion—Methyl Salicylate Emulsion . . . .

XXXIV. DISPERSIONS 554
Dispersions of Insoluble Powders — Carbon Black Dispersion—Carbon Black Dispersant—Dispersing Agents . . . .

INTRODUCTION

ALTHOUGH emulsions are finding newer and wider applications each day, basically they are not new. In 1674 a paper was read before the Royal Society, describing experiments whereby oils, resins and gums were incorporated in vinous and aqueous media.[1]

The reasons for the increased use of emulsions are several. Due to the fact that emulsions contain water and a water-insoluble liquid, they are useful in cases where the action of both liquids is desired. It is not possible to apply an oil paint, on a humid surface if the oil paint is not emulsified. There is no other way of covering the humid surface with the oil paint.

In an emulsion, the penetrating power and the spreading ability of the constituents are ameliorated. This is very important in many cases, e.g., with an insecticide, where a good and quick penetration of the active agent is essential.

Another reason for using an emulsion is that water is an inexpensive diluent; however, water-immiscible liquids cannot be diluted by merely adding water if they are not emulsified. Moreover, addition of water decreases the fire hazard of many organic inflammable fluids.

Other reasons for using emulsions are that in emulsions undesirable odor and taste are often reduced. Cod-liver oil, for instance, loses its fishy and oily taste to a great extent when emulsified. Another fact in favor of the use of emulsions is that many chemical reactions are speeded up and are carried through in a better way when the starting material is in emulsified condition. This occurs, e.g., in the preparation of synthetic rubber.

Emulsions would be applied on an even larger scale if their manufacture were less difficult. A little deviation in temperature or in mixing-speed, or small amounts of impurities in the raw material may prevent the formation of an emulsion. Furthermore, emulsions are rather unstable preparations. They are sensitive to heat and cold, and deteriorate easily on aging. As a matter of fact, to produce a stable and good emulsion is not a mechanical process but rather an art.

---

[1] Chemist and Druggist, 132, 475 (1940).

PART I

GENERAL INFORMATION

CHAPTER I

TYPES OF EMULSIONS

O/W and W/O Emulsions

EMULSIONS are dispersions of small droplets of one liquid in another liquid, the liquids being insoluble in each other. One of the liquids is generally water, the other oil. The word *liquid* is used here loosely and embraces various mixtures of fats and waxes, as well as oils and solvents. Oils, when mixed with water, will not form stable emulsions. The small droplets of oil tend to combine to form larger drops and finally two distinct layers will separate. A stabilizing agent, known as an emulsifier, is required for stabilization. This emulsifying agent forms a film around each of the dispersed droplets preventing it from combining with others to form larger drops. In some cases one emulsifying agent may not be sufficient to form a stable emulsion and to prevent separation. In this case several emulsifiers may be used.

The emulsions may be dispersion of oil in water (O/W) or water in oil (W/O) or dual emulsions which are a mixture of O/W and of W/O. In an O/W emulsion oil is dispersed in water. In this case, water is called the external or continuous phase and oil is called the internal or discontinuous phase. In W/O emulsions, water is dispersed in oil. In this case the water is the internal or discontinuous phase, and the oil is the external or continuous phase.

A number of methods is available for determining the type of emulsion formed. The simplest test is based on the fact that an emulsion can only be diluted with the continuous phase. The emulsion is added to a small amount of water. If it spreads and mixes with the water, it is an O/W emulsion; if it does not mix, it is a W/O emulsion.

Another method consists in dusting an oil-soluble dye on the surface of the emulsion. It will only be colored if oil is the continuous phase (W/O emulsion). If it is not colored, then it is an O/W emulsion.

Still another method of determining the type of emulsion is to check the electrical conductivity. If the emulsion exhibits very low conductivity, it is of the W/O type, as the oil which forms the continuous phase will not conduct an electric current. O/W emulsions, on the contrary, are moderately good conductors of electricity, water being the continuous phase.

A parallel bundle of light rays, going through a droplet of O/W emulsion, will be converged; through a W/O emulsion, it will be diverged.[1]

Emulsions of the W/O type usually form when the ratio of water to oil is low. The addition of more water often reverses the emulsion.

Systems containing less than 25% water usually form W/O dispersion, while systems containing more than 31% water usually form O/W dispersions. In extreme cases, W/O emulsions may be formed with less than 10% water, or O/W emulsions with more than 45% water. Between 10 and 45% water content, the factors that exert the chief effect in determining the type of dispersion are the relative specific gravities, viscosities and dielectric constants of the oil and water, the pH of the water, and the effects of emulsifying agents. In a relatively narrow transition zone, the character and intensity of agitation determine the type of dispersion.

Where a W/O type of emulsion is desired the water should be added to the oil. For an O/W emulsion the oil should be added to the water. This does not imply that the desired type will always form, but only that with all factors equal, the formation of a certain type will be favored.

Whether the W/O or O/W emulsion is formed depends to a great extent on the emulsifier used. Hydrophilic water-soluble emulsifiers, such as gum arabic, gelatin or soap tend to form O/W emulsions.[2] Hydrophobic oil-soluble emulsifiers, such as metallic soap, tend to form W/O emulsions. Emulsifiers which have both hydrophilic and hydrophobic properties may produce both types of emulsions. The phase which has a greater affinity for the emulsifier tends to become the dispersion medium, i.e., external phase. The droplets of the dispersed phase will be surrounded with a protective film of the emulsifier.[3]

Thus, if an oil is shaken with a dilute soap solution, an O/W emulsion results because the soap is soluble in the continuous and not in the dispersed phase. If some calcium oleate is dissolved in the oil and then water is added, a W/O emulsion results.

O/W emulsions of castor, olive, or cod liver oil are formed when using caesium, potassium, sodium, or silver soap. The degree of emulsification decreases in the above order. Calcium, magnesium, zinc, aluminum, and iron hydroxides form W/O emulsions.[4]

Inversion

When the amounts of two phases in an emulsion are in a certain proportion an O/W emulsion[5] may be changed to a W/O type.[6] Thus an O/W soap emulsion may be inverted by the addition of calcium or zinc salts, which form metallic soaps that favor the W/O type. This inversion is easily shown by the increase in electrical resistance of the latter.

Inversion may be caused by change in concentration of one of the phases, by chemical or physical changes produced on aging.

Sodium chloride inverts W/O emulsions when the less soluble sodium soaps are used as emulsifiers, but not when the more soluble ones are used. Potassium chloride does not invert emulsions made with corresponding potassium soaps.[7] Cod liver oil emulsions with gum acacia and gum tragacanth change from the less stable O/W to W/O type, during emulsification, caused by slight oxidation of the oil.[8]

W/O crude asphaltic oil emulsions are inverted with potassium or sodium oleate or rosin soap.[9]

Inversion of olive oil emulsions, made with sodium oleate, takes place gradually, not suddenly, in presence of calcium salts.[10]

Water added to a 4% solution of potassium oleate in white spirit forms a rather unstable W/O emulsion until the emulsion contains 1% water. A further addition of water results in an inversion of the emulsion and a separation of white spirit. The inversion is prevented if the potassium oleate contains more than 10% oleic acid. When water is absorbed by a white spirit solution containing potassium oleate, oleic acid and methanol, one of the three types of emulsions results. If the oleic acid content is high and the methanol content small, a low-viscosity emulsion forms. With solutions low in oleic acid and containing between 30 and 40% methanol a W/O emulsion of higher viscosity forms which has a tendency to invert. If the methanol content exceeds 50%, no emulsion forms.

Olive oil and lime water when emulsified with small amounts of powdered mustard produce W/O emulsions. Larger amounts of mustard produce O/W type.[11]

Emulsions of benzene with sodium oleate, and tetrahydronaphthalene with sodium oleate are of the O/W type, and their viscosity decreases continuously with increase in water content. Emulsions of benzene with sulfonated fish oil and caustic soda, and tetrahydronaphthalene with sulfonated fish oil and caustic soda are of W/O type, the viscosity increasing with the water content up to 27%. At these points the systems suddenly change into O/W types and the viscosity increases enormously, after which the viscosity decreases sharply with further increase in water content.[12]

Reversible emulsions (W/O) of castor oil, olive oil and paraffin oil with sodium and potassium soaps increase in viscosity with increase in percentage of the dispersed phase, and the viscosity is greatest at the reversal point. The concentration and specific nature of the emulsifying agent have no effect on the viscosity.[13]

Dual Emulsions

The term *dual emulsion* is applied to emulsions which are mixtures of O/W and W/O types. The dual emulsion occurs usually when a phase reversal takes place.

In some cases it is formed by mechanical action. There is also the possibility of chemical reaction between the emulsifier and one or both phases, producing a different emulsifier which tends toward inversion and in certain cases toward duality. Thus, the chemical and physical character of the components is just as important as the kind of emulsifier used. For example, if the only variation in a given system is in the nature of the oil phase, the same or different type of emulsion will be formed with varying stability. Thus, while gelatin usually gives O/W emulsions with most oils, with cresol it forms W/O emulsions.

Dual emulsions may be formed by purely physical changes: a protein emulsifier may hydrolyze or be denatured; one of the phases may cause a change in pH; a colloid may assume different states of aggregation.

Partition of the emulsifier between two phases may also produce dual emulsions. Where an emulsifier is soluble in both phases, the change in amount of either phase will change the specific partition of the emulsifier.

Lecithin dispersions form dual type emulsions with benzene, carbon tetrachloride, chloroform, cresol, hexalin, linseed oil, phenol, and light petroleum. It is quite likely that the partition of the emulsifier, between both phases, is responsible for the duality. Then again, it may be due to the presence of impurities like cephalin.

Hevea lipin also forms dual type emulsions, as do proteins and similar substances, such as peptone, albumin, casein and gelatin. Here the emulsifier may form protein complexes with resultant duality of type.

REFERENCES

[1] Carriere, *Chem. Weekblad*, **26**, 413 (1929).
[2] W. Meyer, *Farben-Chem.*, **5**, 157 (1939).
[3] Wellman, *J. Phys. Chem.*, **34**, 379 (1930).
[4] Iselin, *Boll. Chim. farm.*, **67**, 225 (1928).
[5] Wellman, *J. Phys. Chem.*, **34**, 379 (1930).
[6] Bhatnagar, *J. Chem. Soc.*, **117**, 542 (1920); **119**, 61, 1766 (1921).
[7] Tartar, *J. Phys. Chem.*, **34**, 378 (1930).
[8] Smith, *Pharm. J.*, **125**, 91 (1930).
[9] Kadt, *J. Inst. Petroleum Tech.*, **12**, 217 (1926).

[10] Dixon, *Sci. Proc. Roy. Dublin Soc.*, **19**, 421 (1930).
[11] Cowan, *Spice Mill*, **57**, 175 (1934).
[12] Parke, *J. Chem. Soc.*, **1933**, 1214.
[13] Joshi, *Trans. Faraday Soc.*, 1925.

CHAPTER II

EMULSIFYING AGENTS

AN EMULSIFYING agent has the task of lowering the interfacial tension and stabilizing the emulsion. The lowering of interfacial tension means reducing the cohesion in the liquids and increasing the dispersion of one liquid in the other. To produce a stable emulsion, the emulsifying agent should form an interfacial film, that is, a film around each of the dispersed droplets to prevent these droplets from combining with each other.

There is no one emulsifying agent which will serve equally well in all varieties of technical emulsions. One which gives excellent stability, in certain cases, may be ruled out in other cases because of cost, odor, color, toxicity, viscosity, or other properties which it may impart to the emulsion. For this reason, the number of emulsifying agents used is legion. Furthermore, it is often necessary to employ a mixture of emulsifying agents to obtain the desired effect.

In the following paragraphs the most common emulsifying agents are described.

Acacia Gum

Acacia gum or gum acacia is one of the most commonly used emulsifying agents in medical emulsions. It favors the O/W emulsion. Acacia or other gums should not be used for externally applied medicinal emulsions as they leave a sticky layer on the surface of the body. Gum acacia does not form a stable emulsion combined with bile salts. It was found that when Turkey red oil, lecithin and sodium oleate were mixed with gum acacia, the emulsion formed liberates oil slowly at the top, although when gum acacia is present alone no such separation is observed. Gum acacia, when mixed with gelatin, egg albumin, saponin, Irish moss, agar-agar or gum tragacanth, stabilizes the emulsion, instead of causing liberation of oil.

In the preparation of emulsions by use of a hand homogenizer, a mixture of acacia and tragacanth (3:1) gives better results than either gum alone. The mixture of gums gives emulsions that are whiter than those made with tragacanth alone and shows less creaming than those made with acacia alone. These results hold true for cod liver oil, linseed oil and mineral oil but not for castor oil. The use of tragacanth in combination with acacia is of no advantage if the emulsions are made with a mortar and pestle. From the results of viscosity tests, it appears that the beneficial results obtained by addition of tragacanth in certain cases are due to factors other than viscosity alone.

Agar-Agar

Agar-agar absorbs considerable quantities of water and is used also in medical emulsions. It is very useful combined with acacia gum. It should be used in solution and kept warm until the emulsion is completed, as agar gels at about 40° C.

Bile

Bile is an important emulsifying agent in the physiological process of fat resorption in man and animals. It emulsifies the fat in the intestine and prepares it to be absorbed by the intestinal walls. A study was made of the emulsifying action of bile [1] on the systems, benzene and water, sunflower oil and water, fish oil and water and paraffin oil and water. A similar study was made of egg yolk on the system benzene and water. Bile and egg yolk proved to be strong emulsifiers.

Carbohydrates

Carbohydrates are not very important emulsifying agents. They are used because of their ability to increase viscosity and to lower interfacial tension.[2] The chemical nature of the oil, and also of the liquids being emulsified, influences the efficiency of sugar as an emulsifying agent. The inversion of sucrose is accompanied by a slight increase in surface tension, but invert sugar is no more efficient than sucrose in holding up suspensoids or emulsoids. Dextrin is a better emulsifying agent than starch; viscosity and lowering of interfacial tension are again the predominating factors. However, viscosity is, in this case, of secondary importance. Lowering of interfacial tension and viscosity produce favorable emulsifying conditions for solutions of gum arabic.

Cholesterol and Lanolin

Cholesterol is the active emulsifying principle in lanolin. It promotes W/O emulsions. The emulsifying power of cholesterol is somewhat increased by the presence of other substances contained in the lanolin. Isocholesterol, another constituent of lanolin, has no emulsifying properties and its removal from lanolin increases the emulsifying power of the lanolin.

Egg Yolk

Egg yolk is used especially in food emulsions such as mayonnaise. Its emulsifying properties are mainly due to its lecithin contents. Its content of protein adds to its emulsifying ability.

Gelatin

Gelatin belongs to the group of protein emulsifiers and has the advantages and disadvantages of the group. Protein emulsifiers are relatively inexpensive but decompose easily.

When gelatin is used as an emulsifier the best results are obtained when the following rules are observed:

1. The surface tension should be lowered as much as possible.
2. No excess of strong acids, bases or liquefying salts should be added.
3. The viscosity should be as near that of water as possible.

Gelatins from which organic and inorganic impurities have been removed are more efficient emulsifying agents than the same gelatins with the impurities.[3] The source from which the gelatin is obtained, and the treatment to which it is subjected before the gelatin is extracted, has a marked effect on the emulsifying power of the gelatin. Gelatins which have been previously treated with alkali are more efficient as emulsifiers. Oils containing double or triple linkings are more easily emulsified with alkali-treated gelatin than saturated hydrocarbon oils.

Of the different varieties of gelatin derived from bone, calfskin, or pork-skin, the latter gave best results in a typical oil emulsion. Gelatins having a high bloom rating (250 g. or higher) give better emulsions. Of course, the method of preparation of the gelatin, its age, purity and isoelectric point, are very important factors.[4] Using pork-skin gelatin of a good grade, pH 3 was found most suitable. Since good commercial gelatins have a higher pH, the latter may be decreased by the addition of acid (tartaric acid is used for pharmaceutical emulsions). An alkali-treated high-grade gelatin (Pharmagel B) of an isoelectric point 4.7 requires a much higher pH (around 8) for making good emulsions. The pH is adjusted with sodium bicarbonate.

Alcohol, sugar and glycerin are compatible with gelatin emulsions. The latter two, in certain quantities, improve the emulsion. Gelatin should not be combined with other emulsifying agents. Emulsions made with hot gelatin solutions are more stable than when cold gelatin solutions are used.

A homogenizer is preferable to a colloid mill in making liquid emulsions with gelatin as it gives finer and more uniform emulsions. It is important to exclude air or other gases as far as possible. Gelatin solutions hydrolyze on warming and on aging.

Lecithin *

Lecithin is the generic name for a series of phospholipids They are essential constituents of every living cell. Their emulsifying properties are fairly good.

With olive oil,[5] kerosene,[6] and certain bases,[7] lecithin gives O/W emulsions. With some non-aqueous fluids, dual

---

* For more detailed information see page 167.

type emulsions may be formed. Such dual emulsions are formed with toluol, benzol, carbon tetrachloride, chloroform, linseed oil, cresylic acid, phenol, hexalin and light petroleum oil. Impure soya bean lecithin has better emulsifying properties than purified lecithin.[8]

Pectin *

Pectin produces coarse emulsions of apricot kernel oil, cod liver oil and mineral oils and is not a satisfactory emulsifying agent when used alone. When one-half of the acacia is replaced by a small amount of pectin, the emulsion produced is satisfactory, even though microscopic examination shows the globules to be somewhat larger than those produced by acacia alone.[9]

Polyhydric Alcohol Esters and Ether Esters **

The only polyhydric alcohol fatty acid esters occurring naturally are the triglycerides, which are present in various animal oils, vegetable oils and fats. A great many polyhydric alcohol esters and polyhydric ether esters with very good emulsifying properties have recently been synthesized and made commercially available. Typical emulsifiers in this group are listed in the following table.

Glyceryl (Mono) Ricinoleate
Glyceryl (Mono) Stearate
Mannitol Glyceryl (Mono) Laurate
Mannitol Glyceryl (Mono) Oleate
Mannitol (Tri) Ricinoleate
Mannitol Glyceryl (Mono) Stearate
Polymerized Glycol (Di) Laurate
Polymerized Glycol (Mono) Laurate
Polymerized Glycol (Di) Oleate
Sorbitol Glyceryl (Mono) Stearate
Diethylene Glycol (Mono) Laurate
Diethylene Glycol (Mono) Myristate
Diethylene Glycol (Mono) Oleate
Diethylene Glycol Glyceryl (Mono) Oleate
Diethylene Glycol (Mono) Palmitate
Diethylene Glycol Palmitate Stearate

---

*For more detailed information, see page 174.

** For more detailed information, see page 180.

Polymerized Glycol (Mono) Oleate
Polymerized Glycol (Di) Stearate
Polymerized Glycol (Mono) Stearate
Propylene Glycol (Mono) Laurate
Propylene Glycol (Mono) Oleate
Propylene Glycol (Mono) Ricinoleate
Propylene Glycol (Mono) Stearate
Propylene Glycol Glyceryl (Mono) Stearate
Sorbitol Laurate
Sorbitol (Di) Laurate
Sorbitol (Di) Stearate
Sorbitol Glyceryl (Mono) Laurate
Sorbitol Glyceryl (Mono) Oleate
Diethylene Glycol (Mono) Ricinoleate
Diethylene Glycol Glyceryl (Mono) Ricinoleate
Diethylene Glycol Stearate
Diethylene Glycol (Mono) Stearate
Diethylene Glycol Glyceryl (Mono) Stearate
Ethylene Glycol (Mono) Laurate
Ethylene Glycol (Mono) Oleate
Ethylene Glycol (Mono) Ricinoleate
Ethylene Glycol (Mono) Stearate
Glyceryl (Mono) Laurate
Glyceryl (Mono) Myristate
Glyceryl (Mono) Oleate
Glyceryl (Mono) Palmitate

The liquid esters of this group are being used as emulsifying agents in the manufacture of fluid emulsions in textiles, paper, leather, polishes, cosmetics, and certain types of edible emulsions.

The solid esters give stable cream or paste emulsions in numerous industries. They are also of interest as suspending agents in aqueous media, lubricants, shortenings and other products.

The polyhydric alcohol esters are excellent emulsifiers. Some of them yield W/O emulsions, others O/W emulsions. One of the great advantages of these emulsifiers is that they can be used with hard water, as they are not affected by calcium.

Soaps *

Soaps are the most frequently used emulsifiers. They can be added as soap to the water and oil mixture or they can be

---

* For more detailed information, see page 185.

formed during the emulsification. In this case the alkali is dissolved in the water phase and the fatty acids in the oil phase. There are three groups of soaps used as emulsifiers. One group consists of the so-called alkali soaps. They contain ammonium, potassium, or sodium. They are hydrophilic and promote O/W emulsions. Alkali-soap emulsions are sensitive to calcium.

The second group are the metallic soaps in which the fatty acid is combined with Ca, Mg, Zn, Al, etc. These soaps are hydrophobic and therefore favor W/O emulsions.

In the third group the fatty acids are combined with an amino group. These soaps can be used with hard water.

Among the alkali soaps, the sodium or potassium salts of lauric, oleic, palmitic and stearic acids, or mixtures of these, are the most popular. The emulsifying power of sodium stearate and sodium palmitate[10] has been compared by determination of the smallest quantity of soap necessary to emulsify equal volumes of different oils. In general, the emulsifying power of sodium palmitate is greater than that of sodium stearate.

The emulsifying power of soaps in the water-benzene system is, in decreasing order, castor oil soap, sodium oleate soap, and coconut soap.[11] In the presence of calcium ion, coconut soap gives the most stable W/O emulsion at a concentration of 0.05% and castor oil soap at 0.01%.

Acid soaps are sometimes better emulsifiers than neutral or alkaline soaps. Thus, a dilute potassium laurate that would not produce a good emulsion with benzene is considerably improved by the addition of a little lauric acid.[12]

Naphthenic acid soaps [13] are suitable for the preparation of emulsions, but particular care must be taken in determining the amount of alkali necessary for saponification; excess of sodium hydroxide or potassium hydroxide causes rapid disintegration of the emulsion, whereas in saponification with ammonia an excess (up to twice the theoretical amount) must be present in order to stabilize the emulsion. The sodium salt of naphthenic acid is less easily hydrolyzed in water than are the common sodium soaps and its emulsifying powers are much better.

The sodium, potassium and ethanolamine soaps prepared from purified naphthenic acid[14] are appreciably less alkaline in reaction than other soaps; their aqueous solutions, even in high concentrations, do not tend to gel; they are excellent emulsifying agents.

In making emulsions with triethanolamine soaps, quick, thorough agitation is necessary. If the agitation is too vigorous or too prolonged, the emulsion tends to break.[15]

Solid Emulsifiers

Finely dispersed solids can also act as emulsifiers. Like other emulsifiers, they are able to form a protective interfacial film around the dispersed droplets. They can be classified as hydrophobic and hydrophilic solid emulsifiers.

The most useful emulsifying agent in this class is bentonite. While many solids have been used as emulsifiers most of them give coarse temporary emulsions. Hydrous oxides and hydroxides of metals are most effective, their emulsifying efficiency varying with the method of precipitation. The most gelatinous, highly dispersed products are usually best; gelatinous precipitates other than oxides and hydroxides are also effective. Aging in some cases helps and in other cases hinders their emulsifying power.

Aged aluminum hydroxide and partially coagulated ferric hydroxide solutions are better than freshly precipated materials.

Nearly all colloidal hydroxides give O/W emulsions.

Emulsions made with gelatinous hydroxides, although rather coarse, are quite stable and are not affected by electrolytes. Finer dispersions are obtained by combining surface-active materials with them.[16]

Some insoluble emulsifying agents used are: basic metallic sulfates,[17] plaster of Paris, calcium carbonate, powdered carbon, zinc and iron dust, yeast,[18] hydroxides of zinc, lead and aluminum.[19]

The finer the particle size of the emulsifier the finer are the emulsified droplets. The greater the concentration of insoluble emulsifiers the finer the droplet size.[20]

When an O/W emulsion is to be formed the emulsifier should be preferentially wetted by water. Carbon black and lampblack give W/O emulsions with kerosene.[21] A very stable emulsion of gasoline results when carbon black is used as an emulsifier.[22] With bentonite [23] both W/O and O/W emulsions can be made.

Sulfated and Sulfonated Emulsifiers

The sulfated emulsifiers differ from the sulfonated one in that the first-named compounds are sulfates, the carbon being attached to the sulfur by an oxygen. In the sulfonated compounds the sulfur is connected directly with the carbon.

There are various groups of sulfated and sulfonated emulsifiers: sulfated emulsions, sometimes wrongly named sulfonated oils, are very useful emulsifiers.[24] They vary greatly in their effects. Not only do the raw material oils vary in chemical composition but when they are sulfonated, the finished products will vary with the concentration of sulfuric acid used, the time, temperature, water content, washing and neutralizing methods, and other related factors.

These sulfonated oils are effective in weakly acid media. They tend to separate out water, hydrolyze on aging, and split off acid which in turn will react with certain metals with which they come in contact.

In spite of all these disadvantages, sulfonated oils are used in large quantities because they possess certain advantages and are low in price.

They must, however, be bought from reputable houses which standardize their products so that comparable results can be gotten from all shipments.

Analysis of these products is recommended to avoid production difficulties.

For special purposes nearly all commercial, vegetable, animal and fish oils are used. Some sulfonated oils dissolve clearly in water while others do not. The latter class is preferred in fat-liquoring of leather.

Ruemele [25] gives ways of determining the emulsifying power of sulfonated oils.

Sulfonated hydrogenated castor oil is superior to sulfonated castor oil as an emulsifying agent for certain products; a good 25% oil emulsion was produced with 1.25% of the former while an emulsion with 10% of the latter broke. Sulfonated hydrogenated castor oil is therefore preferred to sulfonated castor oil for production of cosmetics. A stable cold cream is readily prepared with 0.035% of sulfonated hydrogenated castor oil as the sole emulsifying agent. A cold cream prepared with 0.025% is stable but requires considerable agitation while cooling. Sulfonated hydrogenated castor oil is also satisfactory as an emulsifying agent for vanishing creams.

Oleic acid or spindle oil can be used with sulfonated oils as emulsifying agents. Sodium hydroxide, potassium hydroxide and ammonia can be used, but the choice of the alkali should depend on the type of sulfonated oil and the purpose of the emulsion to be prepared.

Sulfonated oils are more miscible with mineral oils than with fatty oils. These oils are less miscible with sulfonated castor oil than with sulfonated olive oil. Acid sulfonated castor oil is inferior to acid sulfonated olive oil as an emulsifier for mineral oils. Complete neutralization of a sulfonated oil decreases its miscibility with neutral oils.

Of the sulfated alcohols sodium lauryl sulfate and sodium cetyl sulfate are frequently used emulsifiers. These emulsifiers have the advantage that they can be used with hard water.

Among the sulfonated emulsifiers the salts of the aromatic sulfonates are important, e.g., the salts of the sulfonaphthenates (sulfonate naphthenates).

These sulfonate salts [26] or soaps, as they are sometimes called, are frequently referred to as petroleum sludge soaps, mahogany soaps or petroleum oil-soluble sulfonates. The mahogany sulfonates form unusually stable emulsions of oil and water. They permit the manufacture of mineral oil compositions which emulsify readily, even in hard water, and are stable in the presence of weak acids and alkalies.[27] Their emulsifying power depends a great deal upon their purity, i.e., freedom from contamination with inorganic salts, and the purer the soaps the better their emulsifying ability. Depending on the application and the specific properties desired, small amounts of other products, such as glycols, fatty acid soaps, resinates, and fatty sulfonates, are often used in conjunction with the petroleum sulfonates to increase their emulsifying power. Generally, less than 10% of a good grade of the purified soap is required to emulsify petroleum oil in water without the use of any accessory emulsifier.

Hydrotropic Solvents

Compounds of the type RSO_3M, where M is sodium, potassium, calcium, lithium, or an ammonium group and R is a long chain paraffin or aromatic group, are hydrotropic solvents.

A concentrated water solution (40% or more) dissolves many water-insoluble materials. In some cases, emulsions first form and often may be cleared by the judicious addition of water.

Some hydrotropic solvents are:

sodium kerosene sulfonate
calcium xylene sulfonate
calcium lignin sulfonate

These have been used in making emulsions and solutions of cellulose acetate, pyroxylin, nitrobenzol, methylsalicylate, anethol, essential and perfume oils.

REFERENCES

[1] Ermolenko, *Colloid J. (U.S.S.R.)*, **4**, 85 (1938).
[2] Clark, *J. Biol. Chem.*, **52**, 157 (1922).
[3] Kernot, *J. Soc. Chem. Ind.*, **47**, 96 (1928).
[4] Tice, *J. Am. Pharm. Assoc.*, **24**, 1063 (1935).
[5] *J. Phy. Chem.*, **29**, 587, 738, 834 (1923).
[6] *J. C. S.*, **119**, 1760 (1921).
[7] *J. C. S.*, 51, c.
[8] Puchkobskii, *Colloid J. (U.S.S.R.)*, **3**, 643 (1937).
[9] Goldner, *J. Am. Pharm. Assoc.*, **114**, 44 (1942).
[10] Jajnix, *Kolloid-Z.*, **37**, 139 (1925); White, *J. Phys. Chem.*, **24**, 617 (1920).
[11] Smirnov, *Vs. Na. Is. Inst. Zhirov.*, 116 (1935).
[12] McBain, *J. Am. Chem. Soc.*, **54**, 3266 (1932).
[13] Ohl, *Monatsh. Seide Kunstseide*, **43**, 235 (1938).
[14] Minich, *Textile Colorist*, **60**, 698 (1938).
[15] Freeman, *J. Am. Pharm. Assoc.*, **22**, 232 (1933).
[16] Bennistee, *J. Soc. Chem. Ind.*, **59**, 226 (1941).
[17] Pickering, *J. C. S.*, **91**, 2001 (1907).
[18] Bhatnagar, *J. C. S.*, **119**, 1760 (1921).
[19] Bechold, *Kolloid-Z.*, **28**, 6 (1921).

[20] Moore, *J. Am. Chem. Soc.*, **41**, 940 (1919).
[21] Schloepfer, *J. C. S.*, **113**, 522 (1918).
[22] Odell, *U. S. Bur. Mines Tech. Paper*, **304**, 36 (1923).
[23] Western, *Chem. Age*, **4**, 604, 638 (1921).
[24] Burton, *Sulphated Oils*, Brooklyn, N. Y., Chemical Publishing Co., 1940.
[25] Ruemele, *Seifensieder-Ztg.*, **62**, 393 (1935).
[26] Archibald, *Ind. Eng. Chem., Anal. Ed.*, **14**, 608 (1941).
[27] *Proc. Am. Assoc. Textile Chem. Colorists*, 25 (1931).

CHAPTER III

FOAMS AND FROTHING

FOAMS are related to emulsions in that they represent dispersions of gases in liquids. The formation of foams is called frothing. Foams play an important role in the manufacture of emulsions. It has been found that air is co-dispersed in all emulsions. It is not sure whether air is adsorbed at the surface of the droplets or it is present as a second internal phase.

Substances which lower the surface tension favor frothing. Saponin, e.g., lowers the surface tension.[1] A very marked frothing occurs when saponin solutions are shaken with air. Saponin and other surface-tension-lowering compounds form a protective film around the gas bubbles. The film of a concentrated saponin solution, which encloses the bubbles, is characterized by considerable rigidity which accounts for the great stability of the foam.

The extreme dilution at which this frothing may be observed varies with the different saponins, and may be used to characterize them and also as a means of assay of saponin-containing drugs. The *foam value*[2] of a number of samples of senega root has been found to vary from 1,000 to 3,300; that of sarsaparilla root from less than 40 up to 660.

Saponins are also useful emulsifiers. They have an advantage over soaps and other compounds of a salt-like nature, in that their emulsifying power is not appreciably affected by the alkalinity or acidity of the solution within the limits usually employed.

Pure liquids do not foam.[3] Some impurity must be present in a liquid to make it foam. Expressed chemically, a foreign substance must be molecularly or colloidally dispersed in a liquid in order to make foam. The nature of the added substance has little qualitative effect, that is, nearly all substances induce foaming. Quantitatively, however, there are great differences. A few thousandths of one per cent of some substances produces more foam than several per cent of others, and there is, furthermore, great difference in the stability of the different foams.

If a material is too soluble, or too insoluble, it will not produce a copious foam. A 0.2% concentration of the dioctyl ester of sulfonated dicarboxylic acid forms more foam and a more stable foam than a 0.2% concentration of the dibutyl ester of sulfonated dicarboxylic acid. A 0.2% solution of a sulfated higher alcohol produces more of a froth and a more stable froth than either of the other two materials. This is in line with experience that detergent-type surface-active products are generally better foamers than wetting agent types.[4]

Organic acids, alcohols, amines, aldehydes, ketones, glycerol, sugar, although an aid in the production of foams, decrease their stability. The optimal concentration in 35 such compounds for a maximum of foam is given by Bartsch.[5] Surface activity, solubility, degree of dispersion and viscosity are factors in the effectiveness of each substance. Molecular association or colloidal aggregation decreases the foam-building power of surface-active substances. High viscosity may not aid in the formation of foam, but increases its stability. Mixed solutions of surface-active substances have greater foam-building power than the solution of just one component, unless mixing lowers the solubility.

Egg white is a foam [6] in which protein at the air-liquid interface forms a tough skin. The lighter the foam, the smaller is the wall thickness. Egg white is composed of microscopic particles of protein which make the viscosity very high. On beating, these particles are cut and torn and a relatively low viscosity results. This allows the production of a highly dispersed foam. The stability of the foam is a linear function of the viscosity of the egg white. When certain acids or salts are added to egg white, its pH decreases and a more stable foam results.

A study of salts of triethanolamine [7] indicates that the surface tension decreases and the relative foam production increases with the number of carbon atoms of the saturated fatty acid up to 12, and then decreases. The pH increases with the number of carbon atoms. The stearate, oleate and laurate exhibit the best emulsifying powers.

Spent licorice root[8] is extracted under pressure with 5% caustic soda, and is then concentrated. This acts as a foam stabilizer, giving a tough durable film.

Foamapin,[9] a hydrolyzed protein, gives an excellent tenacious foam film in water. Its durability can be further increased by the addition of inorganic salts.

Stability of whey foams may be greatly increased by addition of: 1. small quantities of calcium hydroxide[10] and its subsequent neutralization; 2. successive small quantities of acid and alkali to the foam while whipping; 3. small amounts of tannic acid, saponin, sodium sulfite or bisulfite. If, in addition to any of the above, the whey solution is heated to 50° C. before whipping, volume and stability of foam are increased.

The following materials are listed according to the descending order of their foaming power in hydrophilic colloids:[11] saponin, molasses, peptone, gelatin, albumin, pectin, casein. For albumin the maximum foaming power occurs just below the coagulation temperature, and maximal foam stability is found at pH 4.7. Replacing air by carbon dioxide or sulfur dioxide decreases the stability but not the amount of the foam.

Soaps foam in the following order:[12]

Castile soap
Palm oil soap
Tallow soap
Potash soap
Palm kernel oil soap
Rosin soap

The foaming quality of soaps in hard water increases when the solution stands. Colloidal substances do not help foaming of soaps or increase the life of the foam.

Certain substances, called antifoams, have the power of destroying foam or preventing the formation of foams. Castor oil, alcohol, ether, for example, destroy the foam produced by saponin. The quantity of defoaming agents used varies with the amount and nature of the foam-producer.

Octyl alcohol[13] is used as a defoaming agent as follows (all suggested concentrations are by volume unless otherwise indicated):

(a) Oil, where foaming is due to presence of water, use 0.0005%.
(b) Varnish inks, use 0.001–0.01%.
(c) Beet sugar, use 0.0005–0.005% of solution.
(d) Paper, use 0.0005–0.005% of pulp.
(e) Analytical procedure, such as analyses of fruit juices, powdered milk, petroleum-water mixtures, etc., use a few drops in 500 cc.
(f) Photographic film developing solutions, spray 1–10 oz. for 200 gal. of foam.
(g) Textile printing, use 0.25–1.5% of paste.
(h) Chemical processes (manufacture of dyes, alum) use 0.1–1.0%.
(i) Wire drawing soap lubricants, use 0.01–0.1%.
(j) Asphalt emulsions, use 0.001–0.01%.
(k) Eliminating air bubbles and *pin holes* in gelatin glue spreading, use 0.01–1.0%.

The most commonly used foam-breakers besides those used in the natural petroleum industry are:

Higher fatty alcohols,
  e.g., cetyl alcohol
Diglycol laurate
Pine oil
Mineral oil
Foamex[14]
Sulfonated oils
Vegetable oils
Ammonium linoleate
Alcohol, denatured
Octyl alcohol
Water-soluble salts,
  e.g., sodium sulfate
Acids, e.g., acetic acid
Tallow

Mechanical methods, such as beating or stirring near the surface of a foaming liquid, the use of screens, a blast of air, and similar devices are frequently used.

REFERENCES

[1] G. Middleton, "The Saponins," *Ind. Chem. Pharm. and Cosmetic Supplement,* May, 1935.
[2] Kofler, *Pharm. Monatsh.*, 3, 117 (1922).
[3] Foulk, *Ind. Eng. Chem.*, 21, 815 (1929).
[4] Sluhan, *Paper Trade J.*, August 22, 1940, 1.
[5] Bartsch, *Kolloidchem. Beiheft*, 20, 1 (1924).

[6] Barmore, *Colo. Agr. Exp. Sta. 46th Ann. Rept.*, 15 (1933).

[7] Fiero, *J. Am. Pharm. Assoc.*, **27**, 658 (1938).

[8] Houseman, *Ind. Eng. Chem.*, **21**, 917 (1929).

[9] Glyco Products Co., Inc., Brooklyn, N. Y.

[10] Roon, *Ind. Eng. Chem.*, **9**, 156 (1917).

[11] Dumanskii, *Schriften, zentral. biochem. Forsh. Inst. Nahr. Genussmittelind (U.S.S.R.)*, **3**, 361 (1933).

[12] Anon., *Soap*, **10**, 19 (1926).

[13] Bennett, *Chemical Formulary*, Vol. 4, Brooklyn, N. Y., Chemical Publishing Co., 1939, p. 100.

[14] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

CHAPTER IV

METHODS, FORMULATION, EQUIPMENT

THERE are numerous ways of making emulsions. The type of emulsion depends on the order of introduction of the phases, the percentage of the phase, and the kind and percentage of the emulsifying agents used. The color of the emulsion depends on that of the prime materials and on the grade of dispersion of the internal phase.

In most cases it is advantageous to add the internal phase slowly to the external phase. In special cases the preformed emulsion [1,2,3,4,5,6] may be used as a base for a new emulsion.

Incorporation of too much air causes extensive frothing, which is detrimental. Dilution of a concentrated emulsion should be accomplished slowly.[7]

For emulsions of O/W type it is usual to put the emulsifying agent in the water phase. When soap is used it may be dissolved in the water phase or it may be formed in situ by dissolving the alkali in the water and the fatty acid in the oil phase. The latter method often gives better dispersions because the emulsion forms spontaneously as soon as the two phases meet. Furthermore, less power is necessary for mixing in such a case. Certain emulsifiers which are dispersible in both water and oils, e.g., diglycol laurate, may be dissolved in either the water or oil phase or both, depending on results desired.

The concentration of the emulsifiers (albumin, sodium caseinate and casein lactate) and the stirring speed are very important.

In making O/W emulsions with soap, the oil and water are alternately added into the concentrated aqueous soap solution. When a wax is being emulsified, it is usual to run the melted wax into the hot soap solution containing all the water. When emulsifying mineral oil with soaps that are soluble in it, a solution of the two is made and then stirred into the water.

Mineral oil emulsions, however, can be made without an emulsifier by shaking a small amount of oil with a large amount of water for 48 hours or boiling a similar ratio under reflux for 30 hours or by dissolving a similar ratio in alcohol and pouring into water.[8]

For petroleum emulsions the alkali is dissolved in water and the fatty acid in the petroleum. On mixing these solutions, soap is formed spontaneously and often gives a finer dispersion than other methods of mixing.

Gums are used as emulsifiers in the following ways:[9]

Continental method: The oil and the powdered gum acacia are ground to a paste. The water is added in two parts, the first part being worked into the paste before adding the second part.

English method: A mucilage of gum acacia and water is formed and the oil and the remaining water are worked in, in successive small portions.

Gum emulsifiers should not be thinned down too much with water, as instability will result.[10]

Emulsions can be made with the help of an insoluble powder, such as clay, zinc dust, or yeast.[11] The emulsification depends on the fineness of the powder, on its quantity and on the presence of other constituents of the emulsion.

Bentonite, the most widely used insoluble powder, is dispersed properly by adding it to water, a little at a time, and allowing it to sink before adding the next portion. When all the bentonite has been added, allow it to soak for 1 or 2 hours, before stirring. Up to 7–8% bentonite may be dispersed in this way.

If a high-speed mixer is available, the bentonite can be added slowly while mixing, and dispersion can be effected in a few minutes. This method and longer mixing may yield dispersion up to 17%.

Emulsification by Ultrasonic Waves

Ultrasonic waves[12] can be used for emulsification because of their strong mechanical energy. The ratio of the phases is a critical factor in these emulsions, which are only stable for a day.

Increasing the disperse phase beyond a certain point is not possible even if the treatment time is greatly extended. If treatment of a good emulsion is continued too long, breaking often results. The inclusion of a protective colloid, however, may prevent this. Highly viscous or elastic materials do not emulsify on ultrasonic treatment.

Emulsifying High-melting Materials

When an emulsion of a solid melting above 100° C. is desired, it should first be melted with sufficient solvent or oil so that the melting point is brought below 100° C., e.g., rubber with naphtha or other hydrocarbons; synthetic resins with hydrocarbons or vegetable oils.

Formulation

The first step in formulation is to choose the ratio of the oil to the water phase. Usually, an increase in amount of the water phase will result in a lowered viscosity of the emulsion. Often, decreasing the amount of the water phase may cause inversion. Low percentages of water in many emulsions produce pasty or even solid emulsions. Since increased viscosity usually increases stability, viscous (concentrated) emulsions are frequently made so that aging and mechanical shock will not break them. These are diluted as required before use.

The amount of the emulsifier used is dependent on many factors, viz., stability, viscosity, type, color, costs, and so forth. It is usual to start out with an amount equal to that used in similar emulsions and work up or down depending on desired results. It is best to work with parts by weight for all ingredients in order to avoid errors due to differences in densities.

Since a test of stability may require *shelf-testing* for some length of time it is best to make up a number of experimental emulsions varying the components within certain limits and allowing them to age.

Emulsifying Equipment

Mechanical forces are instrumental in producing most emulsions. The simplest equipment is a small container which is shaken manually. A second method is stirring, either by hand or mechanically. Finally, there is the machine, such as the colloid mill or homogenizer.

In pharmacy, the mortar and pestle is the most commonly used emulsifying apparatus. The so-called American method introduces the oil phase to the gum dispersion, whereas in the Continental method the water is added to the gum and oil. Both these methods use vigorous agitation and grinding.

Standardized hand shaking of a bottle or closed container is the technic which most closely duplicates mechanical forces and is used in many studies on making and breaking emulsions.[18]

Mixing by agitation is not a simple, uniform operation. The shaft, from the source of power, may be fitted with a propeller, whisk, baffle or similar projection. To get the most efficient dispersion, shearing as well as mixing forces are needed. The size, shape and position of both the container and the attachments are of great importance, not only in getting better dispersions, but in avoiding the introduction of excessive amounts of air.

For every emulsifying apparatus or machine there exists an optimal speed of agitation or mixing and an optimal operating time, whereby the most stable emulsion can be attained for a given mixture. Intermittent shaking may be 600 or even 1000 times more effective than uninterrupted but equally violent agitation. A mixture of benzene in 1% aqueous sodium oleate, when shaken by hand, requires 750 shakes, occupying 4.2 minutes, to emulsify 60% by volume of benzene. The same mixture can be completely emulsified with 5 shakes in less than 1 minute if, after shaking twice, a rest of 30 seconds is permitted.

This example is mentioned to illustrate the point that results are often unpredictable and are best ascertained by experiment.

Mixers

Most emulsions are made by means of electric mixers of various types. It is important to select the right type and size of mixer. The number of propellers on the shaft, their location, angle and pitch are likewise often critical.

To get uniform dispersions it is important that the pressure remain fairly constant. Since the pressure at which the emulsion is brought to the homogenizing valve may vary, it is important that the valves be quickly responsive to slight pressure variations. The higher the pressure used, the finer is the dispersion. The pressure, however, is definitely limited by the size of the inlet valves and the viscosity of the emulsion. Formation of vacuum and air pockets in the compression chamber causes lowered production and variable finished emulsions.

Pressures used vary between 1000 and 5000 lb. per sq. in.

Often two stages of homogenization are used; the first at high pressure and the second at a lower pressure.

Number of Propellers *

Generally mixers with one propeller are used with liquids having low viscosity, such as water solutions, oils, light syrups, varnishes, milks, and so forth.

Two propellers on the mixer shaft are called for with liquids of high viscosity where one propeller cannot set up circulation throughout the entire mass of liquid; also where the liquid in the tank varies in height from time to time.

Note the mixing action of a single propeller, Figure 1, and double propeller, Figure 2. Remember that when two propellers are placed on the mixer shaft, where one propeller requires a certain horse power, each of the two propellers substituted will require approximately half of the horsepower shown by the one large propeller.

Mixer Speed

A high-speed mixer is required with low-viscosity liquids, such as water solutions, light syrups, light oils, varnishes, while low-speed mixers are used in high-viscosity work where mixes are thick, slippery, etc. Where the mix contains crystals, fruit or other solid particles, or tends to foam, low-speed units are designated.

---

* Courtesy of International Engineering Inc., Dayton, O.

Materials containing colloidal matter, such as milk or cream, also require low speeds.

There are also materials requiring medium speeds, such as heavy oils and paints. By high speed we mean 1400 to 1800 R.P.M.; medium speeds, 1150 R.P.M.; low speeds, 100 to 500 R.P.M., generally around 400 R.P.M.

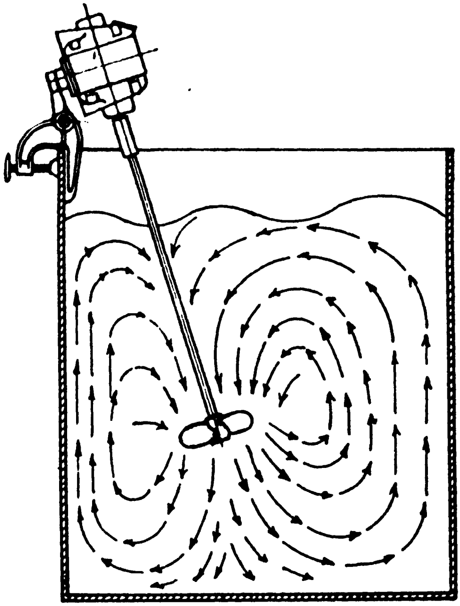


FIGURE 1

Mixing action of a single propeller

Horsepower Required

The horsepower required to mix a certain definite quantity of liquid depends entirely upon the viscosity of the liquid. As an example, a cosmetic cream will require three to four times the

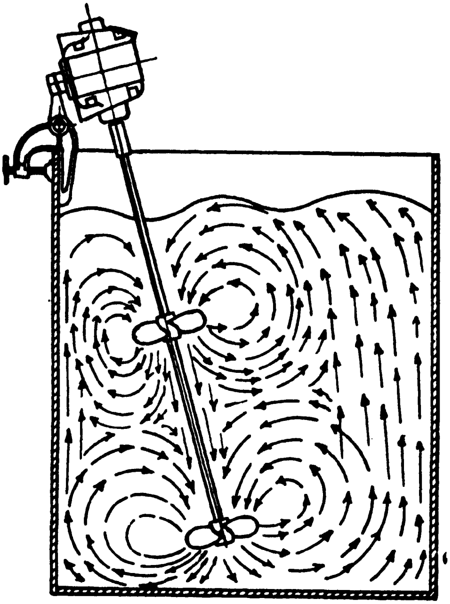


FIGURE 2

Mixing action of a double propeller

power per gallon as compared with an aqueous solution, while rapid agitation of an aqueous solution will take three or four times the power per gallon as compared with slow agitation.

The following table gives the approximate horsepower required for working low-viscosity and high-viscosity materials in tanks of varying capacities, at slow and rapid agitation.

Miscellaneous Data

The best type of tank for mixing is cylindrical. Steam coils or other obstructions in a tank somewhat impede mixer action and often require added horsepower. Rectangular tanks usually require more power than plain cylindrical tanks.

Where mixers are to be used with different-sized propellers, the motor horsepower used should be chosen according to the requirements of the largest propeller required. With rectangular or special-shaped tanks, it is often best to use two mixers of smaller size.

APPROXIMATE AVERAGE HORSEPOWER

	Slow Agitation		*Rapid Agitation*	
Gallons	Aqueous Solution	Paste	Aqueous Solution	Paste
15 to 20	1/30	¼	⅛	½
30 to 40	1/20	⅓	¼	¾
60 to 90	1/20	½	⅓	1
150	⅛	¾	½	1½
250–350	¼	1	¾	2
500	⅓	1½	1	3
800	½	2	1½	5
1200	¾	3	2	7½
2000	1	5	3	10
3000	1½	7½	5	
5000	2	10	7½	
7500	3		10	

NOTE: Medium agitation can be figured to average approximately two-thirds of the horsepower required for rapid agitation.

Among the precursors of the modern emulsifying machine, is found a type which forced the components through a small opening or between two surfaces in motion.[14] Another type forced a preliminary emulsion through capillary tubes at high pressure.[15] A third type continuously forced the preliminary emulsion through a conical spring valve.[16] The *colloid mill* invented by Plauson, forces the liquid between a rapidly moving rotor and a stator. The term *colloid mill* is a misnomer as particles of colloidal size are not necessarily produced by it.

Colloid Mills

Colloid mills,* through popular acceptance and wide usage, have come to be defined as machines whose functions are to disintegrate, disperse, emulsify and mix otherwise immiscible materials. A true colloid mill should be capable of so reducing the particle size of the materials being treated that they will remain in suspension without separation or settling for long periods of time. In achieving stability of emulsions or dispersions, it is sometimes necessary to resort to the use of various chemicals, gums, and so forth, but it is the responsibility of the colloid mill to produce the initial fineness of dispersion or emulsification.

---

* Courtesy of C. O. Bartlett-Snow Co., Cleveland, O.

Any attempt to list all of the industries in which the colloid mill does, or should, find a place would be a huge task, as new uses are found almost daily for this versatile equipment. It is a long step from asphaltic materials and road surfacings to dairy products, mayonnaise and beverage concentrates, but the colloid mill is used in producing all of these. Automobile and furniture polishes, wax and resin paper coatings, jellies, flavorings, vitamin products, various pharmaceuticals and cosmetics, are only a few more of the many emulsions which benefit from treatment in these mills.

The fineness of emulsions or colloidal suspensions depends on the amount of *shearing* which the particles or globules in the mixture receive. Whether this is brought about by sudden violence such as is said to have produced the emulsions found in the oil fields, or to the slow grindings of thousands of centuries which produce the familiar colloidal river muds and clays, is of little moment. Also, it matters little whether the dispersions are produced by hydraulic or attritional shear, providing only the amount of shear has been sufficient.

Colloid mills, in the past, have depended for their results almost entirely on *hydraulic shear.* By passing materials to be treated between the faces of closely adjusted rotors, or rotors and stators revolving at high speeds, *hydraulic shear* acts on the agglomerates, oil or fat globules, breaking them up and dispersing them. Because of practical limitations, the areas of the rotor faces have been relatively small. Many different types of rotors have been designed with a view to overcoming this limitation and creating increased rotor area. How much of the dispersive action in a colloid mill results from the direct attrition of the rotor face, how much from inter-particle impingement, and how much from *hydraulic shear,* has remained problematical. Although some *grinding* action and reduction of particle size has been claimed for colloid mills, several of the

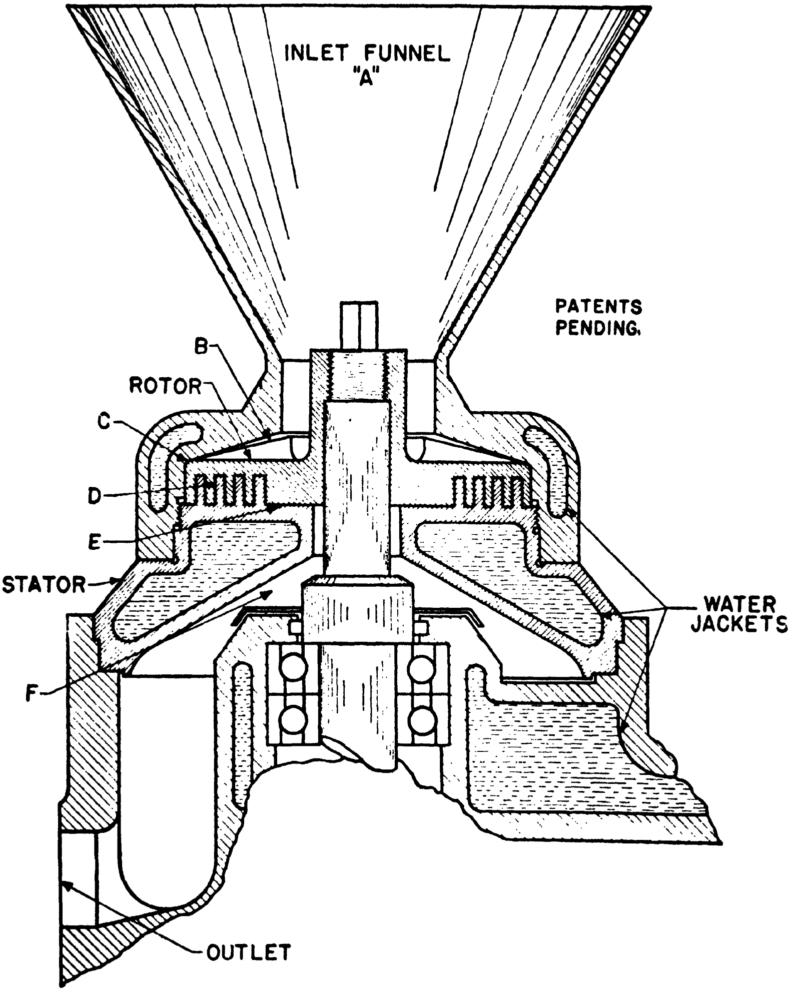


FIGURE 3

Bartlett-Snow triple-action colloid mill

"A," the inlet funnel; B, the impellers or vanes on top of the rotor; C, the close clearance between the rotor and the housing where the first processing action takes place; D, the interlocking rings on the bottom of the rotor and the top of the stator where the second processing action takes place; E, the smooth section between the stator and the rotor where the third processing action takes place; and F, the chamber through which the material drains to the discharge outlet.

foremost authorities on the subject claim that colloid mills do not grind or reduce the size of the particles, but merely disperse the agglomerates.

Generally speaking the essential considerations of a colloid mill, listed in order of importance, are: the efficiency or thoroughness with which the machine disintegrates, disperses, emulsifies or mixes the material; the facility for feeding the machine and for removing the processed material; the ease of disassembly, cleaning, and re-assembly; the absence of packing, glands, etc.; low-horsepower-requirement per gallon of throughput.

The Manton-Gaulin Colloid Mill

The material to be treated is introduced at A and is forced through the first stage-gap B by impellers located on the front rotor face. These impellers also act as cutters and shredders, breaking down and thoroughly disintegrating the material as it passes through. In this gap the material receives a treatment given by no other mill. The pressure built up by the impellers forces the material across the outer edge of the rotor, then inward across the second stage, or back face C, where it receives another and finishing treatment.

It should be noted that in its passage through gap C, the product being treated is traveling counter to the path of centrifugal force. This is of extreme importance. Material in the second stage enters the gap at the periphery, where it covers the maximum rotor area. From here it is crowded and pushed into the diminishing gap area by pressure, and emerges at the center of the rotor, at practically no pressure. In its entire passage through the second, or finishing, stage the material receives the maximum possible rotor action. The second stage C is adjustable by means of an adjusting dial which is calibrated in thousandths of an inch. All adjustments can be made while the mill is running.

The Premier Colloid Mill

A study of the sectional drawing of the liquid type Premier colloid mill shows the material passing through this mill. En-

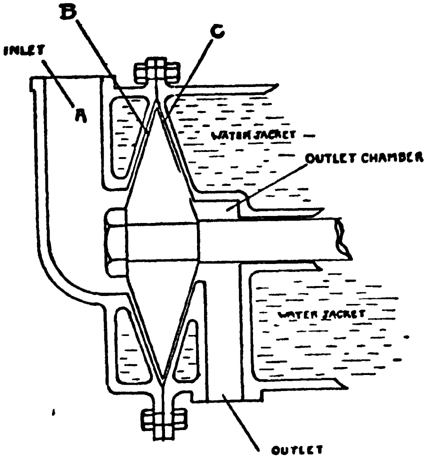


FIGURE 4
The Manton-Gaulin colloid mill

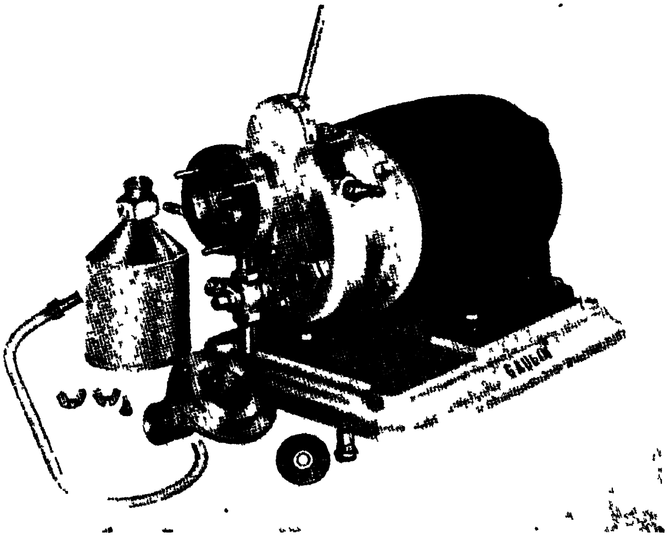


FIGURE 5
Gaulin 2″ mill disassembled

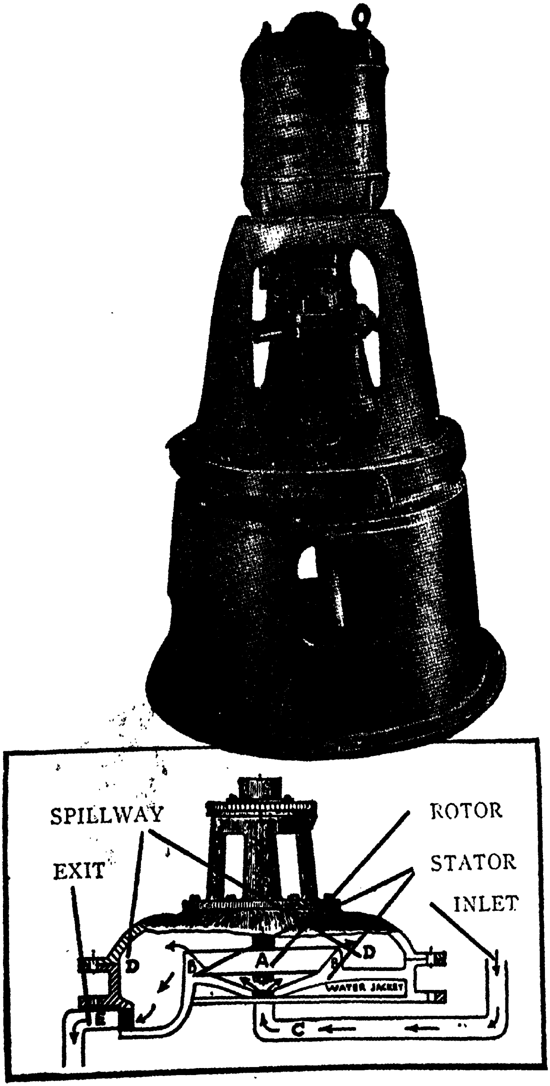


FIGURE 6
Premier colloid mill

tering through inlet C, passing through the clearance between the rotor A and the stator B, materials are discharged through the spillway D.

Homogenizers

The process of homogenization consists essentially in passing the product under pressure between ground surfaces. High velocity, hydraulic shear, pressure release and impact rend the disperse phase (or material to be emulsified or dispersed) into a very fine state of subdivision. The particles or globules are reduced to 1 micron and less in diameter (1 micron is equivalent to approximately 1/25000 inch).

In the homogenzing process, the reciprocating action of a plunger type pump forces the product between the valve seat and the valve. Pressure is applied by a handwheel which restricts the valve gap and. the material is forced through by the pressure which is built up. Since the pressure is positive, receptacles on levels much higher than the homogenizer may be filled directly from the discharge pipe.

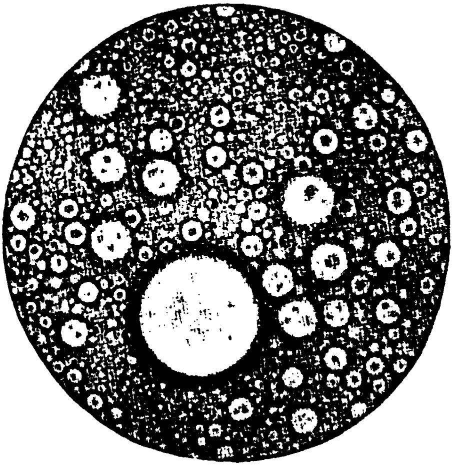


FIGURE 7

Ordinary emulsion magnified × 1,000

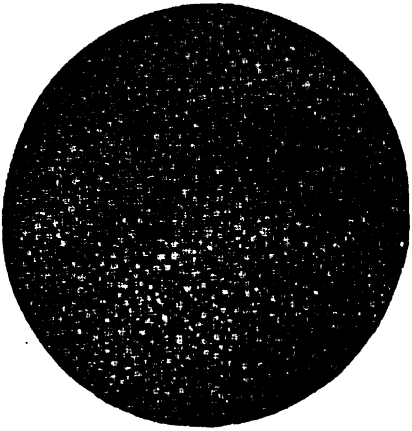


FIGURE 8

Same emulsion processed through the Premier mill magnified × 1,000

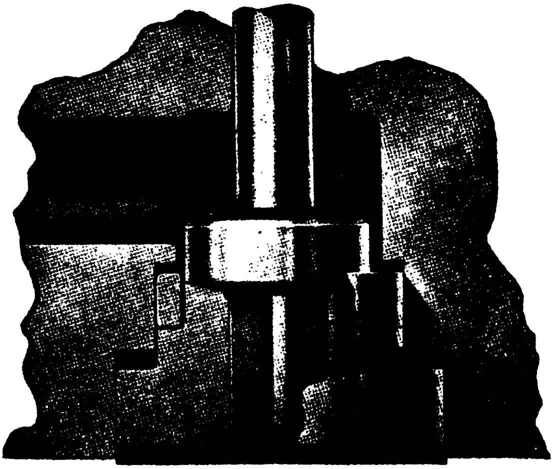


FIGURE 9

Homogenizing valve for the Gaulin laboratory homogenizer

The valve and valve seat are ground to fit each other perfectly. The valve has a long, closely fitted guide or pilot to insure accurate seating.

REFERENCES

[1] British Patent 4,505 (1912).
[2] Lechler, British Patent 254, 701 (1925).
[3] Billinghame, U. S. Patent, 1,700,581 (1929).
[4] Braun, British Patent 254,012 (1925).
[5] Robinson, U. S. Patent 1,923,888 (1933).
[6] Neveu, U. S. Patent 1,525,409 (1925).
[7] Brown, *Textile Colorist*, **57**, 516 (1935).
[8] Lewis, *Kolloid-Z.*, **4**, 211 (1909).
[9] Serralach, *Ind. Eng. Chem.*, **25**, 817 (1933).
[10] Roon, *Ind. Eng. Chem.*, **9**, 156 (1917).
[11] Bechhold, *Kolloid-Z.*, **28**, 6 (1921).
[12] *Science Progress*, **23**, 1, 75 (1928).
[13] Clayton, *Theory of Emulsions*, 1928.
[14] Marix, French Patents 218,946, 218,947 (1892).
[15] Gaulin, French Patent 295,597 (1899).
[16] Gaulin, British Patent 22,875 (1904).

CHAPTER V

STABILITY

A GOOD emulsion should not separate into layers; it should not discolor on aging, and it should not change in consistency. A cream or base emulsion should not become thin or semi-fluid; a liquid emulsion should not thicken and become unpourable. Temperature changes play a great part in variations, and a cream or liquid emulsion which is perfectly satisfactory in cold climates might be far too thin or liquid in warmer climates.

Under the microscope, emulsions appear to consist of small drops of oil suspended in a liquid. The droplets are surrounded by a film which not only impedes their coalescence but also keeps them uniformly dispersed.

The strength and compactness of this interfacial film are the most important factors favoring stability of an emulsion.[1] Most of the other influences are effective only insofar as they modify the properties of the film. The stability, e.g., of an emulsion of moderately high oil concentration is seriously affected by the addition of electrolytes when the amount of emulsifier is insufficient to form a coherent film around the oil globule.

The film-forming properties are not the same with all emulsifiers. For example, under the same conditions, the film formed by sodium oleate is much more resistant than that of sodium stearate. The resistance of sodium stearate is even inferior to that of oleic acid alone. To make a stable emulsion, an emulsifying agent is required that will give pellicles which are resistant to the conditions to which the emulsion will be exposed. The product to be emulsified should either be a liquid or be dissolved during the preparation of the emulsion. It must be subdivided mechanically into very small particles, the smaller the particles the more stable the emulsion. With the same proportions of oil, water, or soap, the emulsion may be fluid, or more or less dense, according to the size of the droplets. Another factor influencing the stability is the viscosity of the dispersion. Viscous emulsions are generally more stable than mobile ones; often, high viscosity is regarded as a sign rather than as a cause of stability in emulsion systems.

The proportion and solubility of the emulsifier in the phase, the stability of the emulsifier in water and air, its resistance to bacterial activity, to heat, to acids and salts, and its ability to form elastic and thin adhesive layers, are important factors in respect to the stability of an emulsion. The specific gravity of the dispersed phase and the surrounding medium influences the stability of the emulsions. The greater the difference in specific gravity, the greater is the tendency for the emulsion to break.

The addition of a larger proportion of water makes some emulsions more stable and others less stable. The activity of emulsifiers can be increased by adding colloids like glue, casein or starch, which render the pellicle surrounding the dispersed substances more resistant.

Viscosity

In any given formulation it may be assumed that the greater the viscosity of the external phase, the better is the emulsification, providing that all other conditions are satisfactory. The viscosity of the internal phase is of little importance.

Emulsions made with natural colloids, e.g., gelatin, gum tragacanth or egg yolk, are more viscous than those made with soap.

The following formula, developed by Stokes, shows the effect of viscosity on the settling rate (see also creaming) of dispersed particles.

$$V = \frac{2r^2(s-s^1)g}{9\eta}$$

V	Rate of settling
r	Radius of dispersed particle
s	Density of dispersed particle

s^1 Density of liquid phase
g Gravitational constant
n Viscosity of liquid phase

Mathematical formulae for predicting emulsion viscosity have been given by a number of other investigators.[2]

Increasing the viscosity of emulsions, when necessary, may be accomplished by changing the ratio of the phases, increasing the amount of emulsifier, inversion of the emulsion type or addition of bodying agents. Such bodying agents for the O/W type of emulsions are hydrophilic colloids such as proteins, alginates, water-soluble gums and water-soluble cellulose derivatives. Where gums are used, high viscosity emulsions are formed. This favors stability because creaming and agglomeration of oil particles are greatly reduced. For the W/O emulsion, metallic soaps like aluminum stearate or calcium linoleate may be used.

Next to the viscosity of the external phase the stabilizer used seems to be of most importance in determining the viscosity of the emulsion. The viscosity of colloidal solutions increases with the thickness of the layer of water covering the colloidal particles.

The viscosity of emulsions of the same pair of phases (paraffin oil and water with sodium oleate) is not dependent on particle size or size distribution within wide limits. Viscosities of emulsions of the same continuous phase and different disperse phases are almost independent of the disperse phase.

Irregularities in viscosity of the same emulsions are most pronounced when freshly made. Exclusion of air from the emulsion gives similar viscosity.[3]

The viscosity of gelatin emulsions is reduced by hydrolysis on aging or heating and also by exposure to ultrasonic waves.[4]

The viscosity of natural W/O petroleum emulsions is increased by ferric ions.[5]

In soap solutions the viscosity is lowered by small additions of electrolytes. This is due to loss of water by the colloidal particle and consequent shrinkage.

Phase-Volume Ratios

Phase-volume ratio means the ratio of the volume of the internal phase to that of the external phase. The relative volumes of the phases affect the type and stability of an emulsion, e.g., if in making margarine, the milk is run into the large volume of oil, while stirring, a W/O type results.[6] When the oil is mixed into the milk, an O/W type forms. In emulsions made with soap, there is no particular limit to the amount of soap, but the amount of water must be sufficient to produce a proper hydrating effect.[7]

The best stability is observed when the internal phase occupies a volume of 40–60% of the emulsion. If the internal phase falls below a volume of 30% or goes above 70%, the emulsion will break easily. If the internal phase rises above 70%, the dispersed droplets are packed so closely together that they lose their shape. By the deformation of the droplets, the interfacial film will break and the unprotected droplets will coalesce.

Creaming

Creaming is the formation of a more concentrated emulsion layer. The more concentrated emulsion layer contains a higher amount of the internal phase than the rest of the emulsion. A simple test for creaming is to dip a finger in the emulsion. If there has been creaming, some of the emulsion will stick to the finger instead of draining off quickly.[8]

The creaming can be upward or downward. This depends on the relative specific gravities of the external and internal phases.

In O/W emulsions, creaming takes place at the top if the oil is lighter than water. If the oil is heavier, the cream forms at the bottom.

The speed of creaming depends on the specific gravity of the phases, the viscosity of the external phases, globule size, and other variables.

From the Stokes' sedimentation equation (p. 43) it is possible to deduce the influence of the several factors mentioned above on the speed of creaming.

The velocity, with which the particles of the dispersed phase cream, is directly proportional to the difference in density between the oil and water phases and the square of the diameter of the dispersed particles. It is inversely proportional to the viscosity of the external phase. Thus, if the diameter of the dispersed particle is reduced one-half, a given amount of creaming would require four times the time interval. Emulsions of sufficiently small particle size may never cream, e.g., homogenized milk.

Retardation of creaming is helped by agitation or by the addition of a heavy or light material to change the ratio of the specific gravities of the external and internal phases.

Particle Size

The particle size of emulsions varies within wide limits. In transparent emulsions the particles are smaller than the wave length of light (less than 10^{-5} cm.). Bluish milky emulsions are composed of particles of the size of 10^{-4} to 10^{-5} cm. White emulsions contain particles 10^{-4} cm. and larger.

Thus, the transparency or color of an emulsion indicates the particle size and in some cases is an indication of stability and certain physical characteristics.

The stability of an emulsion is best when the size of the dispersed droplets is small and uniform. Particles larger than 25 r. favor the decomposition of the emulsion. The best size lies between the 0.5–1.5 r. Fine particles can be obtained by appropriate equipment and appropriate choice of the emulsifier.

The stability of an emulsion can be predicted if the size distribution of the globules is known.[9] The method of determining distribution (size-frequency) is as follows: The emulsion is diluted with an equal amount of strong gelatin solution. This is examined at about 1100 diameters through the microscope. The approximate size of the globules is determined with a squared eye-piece, calibrated by means of a stage micrometer. Counts of various sized groups are made and compared with counts of similar emulsion samples. To keep errors at a minimum, at least 1000 globules are measured and counted, using at least two slides and several non-contiguous fields on each slide.

It is also necessary to vary the focus so as to examine different depths of the film.

Emulsifiers and Constituents

Where hydrophilic colloids are used, the emulsions have a larger particle size than when soap is used, but are more stable.[10] The former are less affected by addition of an electrolyte and rise of temperature. Their emulsions are more viscous and may even gel.

Hydrophilic emulsifiers that do not form gels form an emulsion of fine particle size, but because of the low viscosity of the continuous phase, relative instability results.

Deterioration of hydrophilic stabilized emulsions, which appear stable when made, is often caused by the gradual growth of the droplets of the dispersed phase, without actual separation.

Tragacanth stabilized emulsions of vegetable and mineral oils are especially stable between pH 1.9–2.3. Acacia has a stability range between pH 2–10 and shows a higher dispersion.

When using gelatin, the pH is also of importance.[11] Changes in stability of gelatin stabilized emulsions at various pH values are related to changes in surface tension and viscosity of gelatin sols with changing pH.[12]

A benzene emulsion, stabilized with gelatin at its iso-electric point (where surface tension and viscosity are lowest) showed great stability. Gelatin emulsions will vary because of variations in the gelatin and because many are not made at a uniform pH.

Saponin stabilized emulsions are very sensitive to calcium, whereas gelatin stabilized emulsions are not broken by calcium chloride. Agar and lecithin stabilized emulsions are coarsened and show lower stability when treated with calcium chloride. It appears that emulsions made with hydrophilic colloids which give the greatest viscosity are more stable to calcium ions. The addition of small amounts of acid has a similar effect.[13]

Thus, emulsion films can be stabilized and toughened by these and other various additions. So, the addition of a small amount of sodium sulfate to a kerosene emulsion with gelatin increases stability.[14] Sodium silicate is helpful in certain soap emulsions.

Octane emulsions with certain soaps are less stable when freshly made.

Benzene emulsions made with soap are adversely affected by addition of oleic acid to the oil phase or alkali or salt to the aqueous phase.[15]

For benzene, toluene and xylene, potassium oleate is a better emulsifier than sodium oleate. Sodium chloride breaks these emulsions more readily than potassium chloride. Stability of xylene emulsions with soap is improved by phenol or its derivatives.[16]

Glycerin stabilizes oil emulsions with soap and Irish moss.[17]

Gum acacia stabilizes oil emulsions with soap.

Water-oil emulsions may be stabilized with a dammar solution.[18]

Stability of olive, castor, and cod liver oils is increased by a little free fatty acid, using caustic soda as the emulsifier.

Emulsions containing free alkalies that may be stable when made or kept in air-tight containers develop a scum on the surface when in contact with air, due to absorption of carbon dioxide, and begin to break at the surface.[19]

Precipitates in emulsions may be due to excess of a sparingly soluble ingredient or the formation of an insoluble reaction product, e.g., a lime soap formed from dissolved calcium compounds and soap. Such reaction products may form slowly, but will definitely affect stability.

In W/O emulsions containing coal particles, the latter are held in suspension at the water-oil interface. The coal particles tend to displace the emulsifier and to break the emulsion.[20]

Sulfonated cod oil gives stable emulsions only at pH 7.8–12.0. These emulsions dilute readily and are broken by more than 3% salt.[21]

A mixture of alizarin oil and spindle oil gives an emulsion, the stability of which increases (pH 6.9–7.0) with the increase of alizarin oil (from 10 to 40%). A mixture of sulfonated train oil and spindle oil, in general, gives more stable emulsions than a similar mixture with alizarin oil.

Vegetable and mineral oil emulsions prepared with gum acacia are stable between pH 2–10. Changes of pH do not affect the relative viscosities or surface tensions of these emulsions. Emulsions made with gum tragacanth are most stable at pH 1.9–2.3 and are unstable when alkaline. They also change in particle size and viscosity with change in pH. Stability decreases with increase in particle size.[22]

Oil emulsions with Irish moss are broken by a trace of soap. Addition of a little glycerol prevents breaking. Larger amounts of soap aid emulsification.[23]

The stability of water-gas tar emulsions, in which water is the dispersed phase, is increased as the completeness of oil cracking is decreased and is affected both by the condensing and cooling methods and the quality of the tar itself. Usually the tar which condenses from the gas in the early stage of cooling forms the most stable emulsions. The free carbon of the tar is the emulsifying agent causing the production of emulsions, its effect, however, not being the same for each of the oil constituents of the tar. In ordinary operation the most stable emulsions are formed of those tars which contain the largest percentage of saturated oils.

The optimal per cent of carbon for the formation of stable emulsions varies with the oil and the tar; if present beyond this amount, there is a distinct tendency for the agglomeration and separation of the water with the formation of tar-carbon amalgams. The amount of carbon to be added depends primarily upon its fineness of division. The rate of separation of water by setting or otherwise is not the same in different emulsions, but is dependent on the temperature of the emulsion, specific gravity and composition of the tar, soluble constituents in the water, size of the dispersed water droplets, and other variables.[24]

Preparation of carron oil revealed the following: The oils which yielded the most stable emulsions were olive, sesame, rape-seed and apricot kernel. Corn, cottonseed and linseed oils gave inferior emulsions.[25]

Emulsion breakdown in O/W type creams is often caused by the use of insufficient emulsifying agent, by the manner in which the constituents are incorporated, by the use of an oil that is too light and by the reaction between the emulsifying agent and other constituents in the preparation. In the case of liquid beeswax-borax emulsions, more stable products may be secured by the addition of Castile soaps or a gum mucilage, such as quince-seed, or such emulsifying agents as glycol stearate or oleate, and so forth. Breakdown in W/O types is caused by heat, chemicals, incompatibilities, lack of homogeneity, insufficient emulsifying agent and improper selection of waxes as hardening agents.[26]

The presence of a gas is an important factor in the stability of some emulsions. When certain liquids are freed from gas as completely as possible, and emulsification is attempted in a vacuum, no emulsion is produced, whereas introduction of a gas will yield a good emulsion. Air, as well as inert gases, may serve in this stead. It may be that thin layers of gas envelop the droplets and retard or prevent coalescence, e.g., emulsions of paraffin oil and toluene containing a gas are formed more easily and are more stable than if no gas is present.[27]

Temperature

Many emulsions are broken by freezing. Freezing breaks them by destroying the membrane of emulsifier surrounding each globule, rather than by the mere freezing of the continuous phase.[28]

Some emulsions can be frozen solid and thawed without breaking. Supercooling without actual freezing is often possible, but freezing usually results in breaking. On freezing and thawing, with resultant breakdown, the emulsifier may disappear from the water phase.[29]

Heat may produce profound chemical or physical changes which may break an emulsion. Heating of emulsions made with hydrophilic agents usually increases globule size. Agar stabilized emulsions break at temperatures above the gelling point of agar dispersions. Lecithin emulsions are less affected by heat.

Heat should only be used to render a very viscous or solid phase fluid. In the latter case, when manufacturing emulsions, the water phase should be heated to about the same temperature, to avoid chilling and solidifying the solid phase. No higher temperatures should be used than are necessary.

Electrolytes

The dispersed droplets of an emulsion carry an electric charge. Electric charges of the same kind (positive or negative) repel each other. The droplets are kept dispersed partly because of the repellent electric charges they carry. The electric charge is proportional to the surface. The smaller the droplet the larger is the relative surface and the higher the relative charge.

The addition of electrolytes may act favorably or unfavorably on the stability of an emulsion. Electrolytes discharging the internal phase will promote coalescence.

Electrolytes may act upon an emulsifying agent and destroy this action. This happens after the electrolyte induces coagulation (salting out) or change of the chemical nature of the emulsifying agent (forming a precipitate). On the other hand it is possible that small quantities of electrolytes increase the potential of the electric layer of the interfacial film. They may sometimes be very helpful in stabilizing emulsions.[30]

A difference of potential exists between the dispersed and the continuous phase. A difference of about 0.06 volts affords a fairly stable emulsion. When it becomes zero, the emulsion breaks.

Causes of Instability

Many persons are completely at sea when a preparation separates. The causes of separation are not so numerous. Some of them, of course, are due to physical reactions about which little is known. Among the causes encountered are:

Decomposition

This usually occurs when mucilages, albumen and animal products are used as emulsifying agents, and is due to the lack of, or an insufficiency of, preservative.

Incompatibility

This occurs when the emulsion contains an ingredient which is incompatible with the emulsifying agent and causes it to precipitate, e.g., borax in an emulsion containing gum acacia; mineral acids in emulsions containing albumen. Another very common instance of incompatibility occurs in connection with an attempt to make an acid emulsion with a soap emulsifying agent.

Insufficient Dispersion

This is due to insufficient reduction of the dispersed phase because of inadequate equipment or improper technique. There are any number of emulsions that will separate on standing when mixed in the ordinary way but will stand up indefinitely when mixed properly as, for instance, in a colloid mill or homogenizer.

Excessive Dispersion

This is the reverse of the foregoing and is due to such fine dispersion that the properties of the emulsifying agent are destroyed. This condition frequently occurs in connection with preparations containing vegetable mucilages, which should be mixed at low speeds with a paddle type mixer.

Electrolytes

The presence of salts, especially those of calcium, magnesium, aluminum, copper, iron, zinc, bismuth, mercury, are likely to destroy emulsions, but in some instances very small quantities can be added after the emulsion has first been formed.

Temperature

Numerous emulsions will break if exposed to low temperatures; others will break if exposed to high temperatures. Emulsions containing soap are likely to be sensitive to cold; those containing animal products are likely to be sensitive to heat. Sometimes, a temperature variation of 20° one way or another will cause separation, as for instance, when emulsions are heated by attrition in going through a colloid mill, or by pressure in a homogenizer.

Insufficient Viscosity

Many emulsions will separate if not sufficiently viscous. This can be remedied by the addition of a thickening agent that will raise the degree of viscosity.

Improper Procedure

Some emulsions must be mixed slowly; others must be mixed rapidly. Some will require the making of a primary emulsion first which can be diluted after emulsification has been effected. Chemicals like sulfur, camphor, and so forth, cannot be added to the batch directly but, if first dissolved in a fixed oil, can be emulsified very readily.

Failure to Distinguish Types

Attempts to add water to W/O type emulsions or oil to O/W types will cause separation. Many fail to distinguish between these two emulsion types. They assume that because the emulsion contains more oil than water they can add more oil to it, whereas an emulsion can consist of 90% oil and 10% water and still be an O/W emulsion.

Improper Emulsifying Agent

No one emulsifying agent is suitable for all emulsions. The user should know what emulsifying agents are best for his particular emulsion. Often a stable emulsion can be secured by changing its type, that is from O/W to a W/O, an effect which can be accomplished by changing the emulsifying agent.

Improper Storage

In storing emulsions, care should be taken to prevent evaporation which will cause deterioration. Change in composition due to chemical interaction between the ingredients or with the container may also cause breakdown.

Summary

Emulsion instability may be caused by:

Improper ratio of oil and water phases.
Incorrect amount or choice of emulsifier.
Impurities in oil or water phases or emulsifier.
Reaction between two or more components and/or container.
Overheating.
Excessive evaporation.
Freezing.
Mechanical shock or vibration.
Improper balancing of densities.
Improper time or speed of mixing.
Absorption of gases or foreign particles.

Testing Stability of Emulsions

a. The quickest way of testing stability is to use a small laboratory centrifuge. Put the samples in tubes and keep a record of the time required to break them as against a known standard.

In order to see how emulsions will resist cold, put samples into a refrigerator and keep the temperature around the freezing point for a few days.

To check heat resistance put samples into a thermostatically controlled electric oven and keep them there for a few days at a constant temperature of 110° F.

b. A glass cylinder 25 mm. in diameter with a bulbous extension at the bottom is fitted with a side cock and rests in a wooden support. The cylinder is charged with 100 cc. of the emulsion and placed in a drying oven to settle at a definite temperature and for a definite time. After 20 cc. of the liquid have been removed and discarded, 10 cc. are withdrawn into a tared aluminum beaker and weighed before and after evaporation in a drying oven. This gives the moisture content. If the emulsion contains B per cent of dispersed phase, a is the percentage of the dry substances of the phase, and b the weight of the evaporated moisture, then the content of non-fatty part in the emulsion is:

$$b(100+a)/a$$

and the stability of the emulsion is:[31]

$$b(100+a)/B$$

c. Two copper plates are kept apart by 2 pieces of glass of about 0.2 mm. thickness with a rubber band around the whole. The breaking of an emulsion is indicated by the glowing of an electric lamp of 50 candle power with alternating current of 120 volts and 50 cycles passing through the electrodes and the emulsion at 40–50° F.

The efficiency of various methods of preparation of emulsions and emulsifying agents is shown by different stabilities of the emulsions.[32]

A finer W/O emulsion of vegetable oil with milk, salt, (margarine) is made by supercooling before adding the emulsifier.[33]

Breaking Emulsions

For some purposes a quick-breaking emulsion is desirable, as in agricultural sprays. Here the emulsion should break as soon as possible after application to the plant and thus release the active ingredient. Such quick-breaking emulsions are usually unstable and are made up just before use. Quick-breaking emulsions usually contain an insufficient amount of emulsifying agent.[34]

In certain cases, it is necessary to break emulsions, e.g., the production of butter from milk by churning. While some emulsions can be broken easily by heat, cold, electrolytes, and mechanical means, others are very resistant to breaking and must be handled in diverse ways.

To decrease the stability or break an emulsion a substance should be added which breaks the film of the emulsifying agent or tends to reverse the emulsion type, e.g., calcium chloride, which inverts an emulsion made with egg yolk and breaks those made with saponin.[35]

As an example of chemical breaking we can take an emulsion of benzene in water, stabilized by gelatin. It is de-emulsified by a sodium hydroxide solution. If the sodium hydroxide is added immediately after emulsification, the separation of benzene starts at once, whereas if the emulsion is left undisturbed for some time before the sodium hydroxide is added, the separation is inhibited for a certain period. This period of inhibition is shown to be a parabolic function of the age of the emulsion. The limiting value found for this period varies directly with the concentration of gelatin used as stabilizer over the range noted from 5 minutes in case of 0.1% to 75 minutes for 0.4% gelatin. It is suggested that after emulsifying, the gelatin slowly forms protecting layers until equilibrium between the gelatin sol and the adsorbed gelatin is reached.[36]

O/W emulsions are broken by many mechanical means. Milk is frothed by introducing inert gas and the cream is separated by a sieve.[37] Butter is separated by boiling milk at a low temperature in vacuo.[38]

Cream is churned in thin layers exposed to vibrational effects.[39] Wool fat is recovered from emulsions by foaming.[40, 41] Emulsions stabilized by proteins can be broken by shaking, heat or chemical denaturants.[42]

W/O emulsions can be broken by such mechanical means as gravity separation,[43] circulating against baffles[44] or oscillating plates,[45] heating[46] and heating under pressure,[47] and similar procedures.[48] Tar emulsions are broken with finely divided inorganic powders;[49] petroleum emulsions are forced through infusorial earth wetted with oil,[50] through sand, silica, alumina[51] or porous diaphragms.[52]

In the laboratory one of the following methods usually succeeds in breaking emulsions: addition of excess of the solvent, addition of a third solvent miscible with each of the other two, destruction of the emulsifying agent, salting out, filtration, heating, freezing, electrolyzing, centrifuging.

If the emulsion is present only as a broad layer at the interface between the two phases, it is best to draw off the emulsion separately and break it.

A small addition of alcohol breaks an emulsion between ether and water. An emulsion stabilized by soap may be broken by adding acid. Formaldehyde breaks emulsions stabilized by proteins. Anhydrous sodium sulfate, ammonium sulfate, or calcium chloride often salts out emulsifying agents. Filtration breaks emulsions stabilized by flocculent precipitates.[53]

Underground water often forms troublesome emulsions in petroleum fields. The stability of these emulsions varies considerably.[54] The amount of water in these emulsions ranges from a trace to more than 60% (average 25%).

The processes for breaking such emulsions include filtration, evaporation, high-voltage alternating currents, direct currents,[55] centrifuging and chemical treatment.[56]

REFERENCES

[1] King, *Trans. Faraday Soc.*, **37**, 168 (1941).

[2] Clayton, *Theory of Emulsions*, p. 130, P. Blakiston Son and Co., 1935; Patrick in Taylor *Treatise on Physical Chemistry*, Vol. II, p. 1314, D. Van Nostrand Co., 1924; Monson, *Ind. Eng. Chem.*, **30**, 1287 (1938).

[3] Narayanaswamy, *J. Ind. Inst. Sci.*, **17A**, 75 (1934).

[4] Porter, *Ind. Eng. Chem., News Ed.*, **12**, 748 (1940).

[5] Sherrick, *Ind. Eng. Chem.*, **12**, 137 (1920).

[6] Clayton, *Margarine J.*, **2**, 30, 503 (1920).

[7] Brown, *Textile Colorist*, **57**, 516 (1935).

[8] Brown, *Textile Colorist*, **57**, 515 (1935).

[9] *Technical Aspects of Emulsions*, p. 52, 53, Brooklyn, N. Y., Chemical Publishing Co.

[10] *J. Soc. Chem. Ind.*, **59**, No. 9, 185.

[11] *Technical Aspects of Emulsions*, p. 112, Brooklyn, N. Y., Chemical Publishing Co.

[12] Limburg, *Rec. Nar. Chim.*, **45**, 772, 854, 875 (1926).

[13] J. Russ, *Phys. Chem. Soc.*, **59**, 1061 (1927).

[14] Holmes, *Introductory Colloid Chemistry*, p. 75, 1934.

[15] Harkins, *Colloid Symposium Monograph*, **5**, p. 19 (1928).

[16] Viekhhertz, *Colloid J. (U.S.S.R.)*, **2**, 133.

[17] Crockett, *Ind. Eng. Chem.*, **9**, 969 (1917).

[18] Holmes, U. S. Patent 1,429,430 (1932).

[19] Davey, *Phys. Rev.*, **11**, 138 (1918).

[20] Hedrick, *Ind. Eng. Chem.*, **33**, 1057 (1941).

[21] Woodroffe, *J. Intern. Soc. Leather Trades' Chem.*, **12**, 419 (1928).

[22] Krantz, *J. Am. Pharm. Assoc.*, **15**, 83 (1926).

[23] Crockett, *Ind. Eng. Chem.*, **9**, 967 (1917).

[24] Odell, *U. S. Bur. Mines, Repts. Investigation*, **2331**, 5 (1922).

[25] Langenhan, *Prac. Druggist*, **42**, 25 (1924).

[26] Deakers, *Drug Cosmetic Ind.*, **43**, 36 (1938).

[27] Rogowski, *A. Pysik, Chem. A*, **166**, 428 (1933).

[28] Rochow, *Ind. Eng. Chem.*, **28**, 1926 (1936).

[29] *Technical Aspects of Emulsions*, p. 146, Brooklyn, N. Y., Chemical Publishing Co., 1936.

[30] Steik, *Am. Dyestuff Reptr.*, **25**, 429 (1936).

[31] Bochko, *Masloboino Zhirovoe Delo*, **11**, 489 (1935).

[32] L. Pick, *Chem. Obzor,* **3,** 202 (1928).

[33] Newton, U. S. Patent 2,232,401 (1941).

[34] *Technical Aspects of Emulsions,* p. 73, Brooklyn, N. Y., Chemical Publishing Co.

[35] B. Egloff, *Emulsions and Foams,* p. 4, 1941.

[36] Nugent, *Trans. Faraday Soc.,* Oct. 27, 1921.

[37] German Patent 314,090 (1918).

[38] British Patent 333,233 (1929).

[39] Perks, British Patent 322,416 (1929); U. S. Patent 1,791,000 (1931).

[40] Broadbridge, U. S. Patent 1,505,944 (1924); Karpinsky, British Patent 177,498 (1922); Bailey, U. S. Patent 1,770,476 (1930).

[41] British Patent 328,606 (1928); U. S. Patent 1,853,871 (1932); German Patent 546,231 (1929).

[42] U. S. Patent 1,728,011 (1930).

[43] Barber, U. S. Patent 1,945,766 (1934); Edwards, U. S. Patent 1,968,131 (1934); Mahone, U. S. Patent, 1,940,726 (1933); Pink, U. S. Patents 1,698,002, 1,698,067 (1929).

[44] Fisher, U. S. Patent 1,942,794 (1933).

[45] Palmer, U. S. Patent 1,781,076 (1930).

[46] Novotney, U. S. Patent 1,968,614 (1934); Turner, U. S. Patent 1,948,481 (1934); Brady, U. S. Patent 1,754,079 (1930); Moscicki, U. S. Patent 1,710,374 (1929).

[47] Champion, U. S. Patent 1,943,367-8 (1934); Dubbs, U. S. Patent 1,123,502 (1915); Elliott, U. S. Patent 1,928,282 (1933).

[48] British Patent 26,228 (1908).

[49] Robinson, British Patent 268,547 (1926); Roth, U. S. Patent 1,665,189 (1928).

[50] Zoul, U. S. Patent 1,501,877 (1924).

[51] Van Loenen, U. S. Patent 1,944,479-80 (1934); U. S. Patent 1,967,601 (1934); Garrison, U. S. Patent 1,947,709 (1934); Eddy, U. S. Patent 1,807,833 (1931); Pollock, U. S. Patent 1,847,413 (1932).

[52] Trumble, U. S. Patent 1,304,124 (1919); Haseman, U. S. Patent 1,914,665 (1933).

[53] W. Weinberger, *Am. J. Pharmacy,* **102,** 594 (1930).

[54] Sherrick, *Ind. Eng. Chem.,* **12,** 133 (1920).

[55] Cottrell, U. S. Patent 987,114 (1911).

[56] Sherrick, *J. Chem. Soc.,* **67,** 63 (1895).

CHAPTER VI

GENERAL TECHNICAL EMULSIONS

THERE are many reasons for the use of emulsions. One reason is that the constituents of an emulsion very often show a greater chemical reactivity than they do in an unemulsified state. This is due to the greatly enlarged area of contact produced by emulsification.

Chemical Activity

When drying oils are emulsified they oxidize and dry more rapidly. Emulsions of some oils are hydrogenated by hydrogen-producing bacteria.[1] Petroleum cracking is furthered by suitable heating of an emulsion of petroleum.[2] Synthetic rubbers are made by polymerization of dienes in emulsion.[3] Vegetable oils, in emulsion, are vulcanized with sulfur.[4] Pigments for latex compounding are protected by wax emulsifiable coatings.[5] Emulsions of heavy liquid hydrocarbons are used in making gas.[6] Liquid fuels are made from emulsions of petroleum oils.[7]

Many syntheses require contact between an aqueous and a water-insoluble phase. The speed and completeness of a reaction are dependent on intimate contact of the reactors. Amines are made by emulsifying alkyl halides with alcohol, water and soap and allowing this to react with ammonia.[8]

Acrylonitrile is polymerized while emulsified with dilute oleate.[9]

Nitration of p-cymene is accomplished by using an emulsion made with Aquasol or Sulfatate.[10]

The effect of emulsification on the rate of hydrolysis of amyl acetate in alkaline solution was determined by using several emulsifying agents. The rate was increased more than 700 times, but was not proportional to the area of the interface when different agents were used. Experiments were made on other reactions between immiscible liquids; in each case the emulsified system reacted more quickly than the corresponding unemulsified but agitated system.[11]

The penetrability of fat liquor emulsions, important to the leather industry, is discussed by Stiansy and Arnoldi.[12,13]

It may be found advantageous, in industry, to apply an oil or related substance in the form of an emulsion in the following instances: when the material occurs naturally as an emulsion; when applying oil-in-water mixtures in which, after elimination of the water, the oil must act as a water-repelling agent; when a comparatively small quantity of viscous oil is to be distributed over a large surface; when a highly viscous oil is to be used in cases where it is impossible to apply heat; when by using an emulsion a final product of special properties is obtained; when the large total surface of the emulsified oil is an advantage; and when the charge on the colloidal particle can be used for electro-deposition.[14]

Agricultural Spray Emulsions

Agricultural sprays are usually O/W emulsions. Those used for killing insects are known as insecticidal sprays, those for insect eggs are termed ovicidal sprays.

The most commonly used oils in agricultural sprays are mineral and coal tar oils and their derivatives. In certain special cases fixed or essential oils are employed. Since most plants are injured by these oils, it is necessary to apply them in a highly diluted form. Dilution with a cheap medium is desirable from the economic standpoint. Water plus an emulsifying agent does this very nicely. This type of emulsion must be O/W so that it can be further diluted in the field, and so that the more active ingredient may remain in the internal phase.[15]

In 1868 an emulsion of cresylic acid, soap and water was first described.[16] In chronological order the following agricultural emulsions were made known: kerosene and whale oil soap;[17] kerosene and soft or hard soap;[18] kerosene and milk;[19] heavy tar-oil.[20]

Compound oil sprays containing fungicides introduce the problem of compatibility,[21] e.g., emulsions containing Bordeaux mixture;[22] nicotine;[23] nicotine sulfate;[24] lead arsenate;[25] polysulfides;[26] miscellaneous sprays.

These emulsions are usually made with cresol soap;[27] sodium resinate;[28] creosote and caustic soda;[29] carbon tetrachloride and cresol soap;[30] tar distillate and rosin soap;[31] fatty acids and glue;[32] pyrethrum extract.[33,34]

Weed killers of the W/O type are intended to kill wherever they contact plant life.[35-38] All other agricultural emulsions are O/W.

Asphalt Emulsions

Road emulsions contain 56–60% asphaltic bitumen, but emulsions can be successfully made with over 80% bitumen.

The most common bituminous emulsions used in road building are made with asphaltic bitumen, a residual petroleum refining pitch. Since their viscosity directly affects spraying and coverage, this property is quite important.[39] Uniformity and globule size of bitumen emulsions are governed by the grade of bitumen used. Since there is a definite variation in every batch of bitumen, it is necessary to regulate the manufacturing procedure in order to maintain fairly uniform production.[40]

While colloid mills are preferred, other mixers may be used in most cases. To get optimal results, experimental runs must be made to determine the best operating conditions.

Bitumen contains acidic materials which saponify with alkalies to form emulsifiers. Where the acidic content is too low, fatty acid or soap is added. Some free alkali is always needed to get the best dispersion.[41,42]

The best procedure is to add the melted bitumen slowly to the aqueous alkali solution, which is heated to a boil in the mixer. Emulsification is complete in 2–3 minutes. At this time some soap or other stabilizer is added if the emulsion is not used at once.[43]

In another method bitumen is melted with fatty acid in the mixer, and then a boiling concentrated aqueous alkali solution is added. This is then diluted with hot water.[44] The significance of various emulsifiers for bitumens is discussed by Rick.[45]

Silica, iron oxide and gypsum promote the formation of asphalt in water emulsions. Limestone, magnesium carbonate, calcium hydroxide, magnesium hydroxide and Portland cement promote water in asphalt emulsions.[46]

Becker [47] gives detailed directions for the laboratory preparation, commercial manufacture and testing of bituminous emulsions. A description of laboratory and technical equipment is also given with the aid of numerous photographs, photomicrographs, diagrams and tables. These tables summarize the results of laboratory tests of the preparation and properties of various emulsified asphalts containing such emulsifiers as tall oil, chlorinated tall oil, montan wax, naphthenic acid, olein and stearin pitch. The optimal proportions and properties of asphalt, water and emulsifier have to be determined for each technical use by a systematic series of tests.

Bitumen emulsions are classified [48] as to stability by Neubronner.

The use of asphalt emulsions for road building and waterproofing of paper, concrete, similar purposes from 1907–1928 is exhaustively reviewed by Leemans.[49]

The degree of dispersion of a bituminous emulsion varies with the pH of the aqueous phase. The stability is greatly influenced by different emulsifiers, e.g., the stability of a Panuco bitumen without an emulsifier or softener lies within the pH limits of 10.2 to 12.5. When emulsified with 0.9% of olein the stability limit is found within a pH range of 8.1 and 12.6.

The emulsifiers should be present in as small a proportion as possible, partially to avoid re-emulsification under traffic, and partially to avoid a decrease of the adhesive power of the bitumen to the mineral matter of the road surface. As a rule, the more finely divided the binding material, the lower is the amount of emulsifier required.

Bentonite is widely used in the manufacture of asphalt emulsions, which should be more correctly described as *aqueous dispersions* of asphalt.

The usual commercial process [50] is to make a bentonite-water paste or gel, which should be as thick as the stirring or mixing mechanism will permit. This will be about 10 to 12 parts bentonite to 90 parts water.

The bentonite-water gel is heated and the hot asphalt poured into it in a thin stream, with continuous stirring. After thorough mixing, the thick product can be further diluted with water, depending on its ultimate use. The final proportions of a fairly thick emulsion could be 10 parts bentonite, 90 parts water and 250 parts asphalt. For asphalt paint, 150 parts water with the above quantities of bentonite and asphalt would be effective.

When the compound has been formed, the bentonite surrounds the asphalt globules, forming a protective sheath against coalescence. The mixture remains plastic when kept in a container, and need not be heated to be applied to a surface. While in the plastic or mobile condition the volume of the hydrated bentonite, due to its swelling properties, is about seven times that of its dry volume. When the material is spread upon a surface the water evaporates, and the bentonite shrinks back to its original dry volume, forming cells of microscopic size between the particles of asphalt. These cells, now dry, are porous and become permeated by the asphalt, which gradually reaches complete coalescence. The film or body is then impervious to water.

The pH value of the final product is an important factor influencing stability. A slightly acid reaction is conducive to maintaining good adherence between the bentonite particles and the asphalt. Bentonite itself gives a slightly alkaline reaction in solutions and aluminum sulfate or small quantities of acids are sometimes added to the water to lower the pH, e.g., 0.007% citric acid.

To improve dispersion, small amounts of other colloids may be helpful. Gum karaya, gelatin, starch, dextrin may be used for this purpose. One patented process mentions the use of a citric or tartaric acid to improve mobility, allowing for fluid emulsions which contain less water and more asphalt. Another mentions that soap-asphalt and bentonite-asphalt emulsions be made separately and then mixed. It is also said that bentonite emulsions may be more successfully made with high melting point bitumens, than with the low melting ones.

There are many patents describing and covering processes and refinements. A partial list follows:

U. S. Patents

1,302,810
1,479,042–43
1,498,387
1,517,075
1,615,303
1,620,899–900
1,663,095
1,663,652
1,679,475
1,690,020
1,691,765–6–7–8
1,722,431–2–3–4
1,725,645–6–7–8
1,733,493–4–5–6–7–8
1,734,437
1,738,509
1,738,776
1,738,906
1,781,654
1,782,536
1,787,418
1,788,706
1,802,561
1,829,722
1,865,634
1,882,834
1,889,437
1,916,885
1,918,759
1,948,881
1,957,408
1,959,586
1,960,112
1,963,231

Whereas some Venezuelan and Mexican asphalts are directly emulsifiable in aqueous alkali (presumably because they contain traces of naphthenic acids),[51] most asphalts require a soap or another dispersing agent for satisfactory emulsification.

A highly important factor in production is the use of soft water. Hard waters must be softened, e.g., by the Permutit or other process, before use. Viscosity plays an important role in the asphalt emulsions for two reasons.[52] First, it governs the workability of the emulsion, which must be applicable to paving aggregate or other surfaces. For this purpose the viscosity must be low. Secondly, viscosity influences adhesion and it must be high enough so that the emulsion clings until phase separation results.

Bituminous emulsions made with soluble emulsifying agents, such as soap, are rendered fluid by the addition of substances, such as calcium chloride, which form insoluble compounds with the emulsifying agent.

Very important also is the stability of the emulsion, since it should not break until after application. A sensitive emulsion will break if the mixer runs too fast, or sometimes merely from gravity flow if the mixer is much higher than the receiving tank. On the other hand, asphalt emulsions may be made so stable that they can be centrifuged without breaking. Tall oil is an effective stabilizer. As a rule an asphalt which is difficult to emulsify gives sensitive emulsions,[53] requiring more stabilizer than a readily emulsifiable asphalt.

Cosmetic Emulsions

Emulsions figure predominantly in cosmetic preparations. The following are typical examples: cold cream, vanishing cream, shaving cream, hand lotion, bath-milk, etc. The first is usually of the W/O type, while the others are O/W.

Commonly used emulsifying agents consist of mixed aliphatic alcohols (about 90%) and aliphatic alcohol sulfates. Such emulsifying agents are readily self-emulsifiable in water, and give creams of the O/W type, such as skin foods, nourishing cream, night creams. On the other hand, they can also form O/W emulsions with a variety of oils, fats, and waxes.[54]

Some of the more recently introduced emulsifying agents, used in the cosmetic industry are:

Acimul
Aminoalcohols
Ammonium Stearate, Anhydrous
Deramin
Diglycol Laurate
Emulgor A
Glyceryl Monostearate
Glycosterin
Mannitol Oleate
Monoethanolamine
Monostearin
Sorbitol Laurate
Triethanolamine
Trigamine
Trigamine Stearate
Trikalin

Errors in Making Creams[55]

When using white oils, paraffin, petroleum jelly, stearic acids, and similar materials in the manufacture of creams, it must always be remembered that the qualities offered vary considerably. There are heavy and light mineral oils, paraffins of varying melting points, and petroleum jellies of varying viscosity. The quantity of water, for instance, which is to be added to hair creams, depends largely on the viscosity of the mineral oil used. It is preferable to use a heavy oil and more water rather than a thin oil and less water. Furthermore, the creams made with heavy oils are usually better and considered preferable by the buyer to those made of thin light mineral oils.

In making face creams the mistake is often made of not working at the correct temperatures. While a cream containing lanolin or similar absorption bases is made at a temperature slightly above room temperature, it is necessary in certain instances to increase the temperature of production. For instance, a higher temperature is required in the case of a mixture of paraffin with an emulsion containing soap, or when ceresin or ozocerite are used. Otherwise it is possible that the distribution of the added wax or paraffin is not sufficiently thorough.

If creams deteriorate occasionally, the reason for this may be that the materials used are not mutually compatible. For instance, the use of lemon juice in an alkaline cream is rather dangerous and often unsuccessful. The presence of electrolytes such as salts of magnesium, zinc, or bismuth may decrease the viscosity. The use of unsuitable emulsifying agents can considerably affect the quality of the cream.

Occasionally insufficient emulsification may be corrected by passing the cream through a colloid mill or homogenizer. In certain instances the stability of the emulsion will thereby be increased and also the quality of the cream be improved. In some cases the stability of the cream may also be bettered by the addition of small quantities of wax and stearic acids. Certain emulsions such as creams containing gums and tragacanth are preferably made without the use of a homogenizer, as the emulsifying properties of the gum or tragacanth may be destroyed. The increased temperature and pressure caused by the passage through the homogenizer may furthermore have a detrimental effect on the already existing emulsion which may be sensitive to heat.

Another mistake which occasionally occurs in cream manufacturing is the simultaneous preparation and use of different types of emulsions. For instance the error may be made of adding comparatively large percentages of lanolin to a beauty milk based on triethanolamine stearate. Through the addition and the ensuing slow increase of water content, a W/O emulsion will first be formed, which will then be changed into an O/W emulsion, with the result that the emulsion is unstable.

Miscible, "Soluble," or Cutting Oils

A miscible oil is a clear solution of an emulsifier in an oil which emulsifies on mixing with water. A cutting oil is a "soluble" oil having lubricating, cooling, and non-corrosive properties.

In making miscible oils a coupling agent or mutual solvent is included to give a clear, uniform solution.

Free oleic acid is necessary to make clear water-miscible "soluble" oils; however, it has a tendency to break emulsions made with a "soluble" oil.

The kind and quality of the mineral oil used has very little effect on the quantity of oleic acid used. Alcohol is usually added. It acts as a liquefier. In large amounts, it causes an increase in the quantity of oleic acid required. It exerts no direct effect on the emulsion.

The addition of alkali to a "soluble" oil, containing acid sulfonated oil, in the absence of alcohol, first decreases, then increases the amount of oleic acid needed; in the presence of sufficient alcohol, the more alkali present the less oleic acid is needed. The more neutralized the sulfonated oil, the better is its emulsifying action.[56]

When soaps are used, phenols are often employed as introfiers[57, 58] as well as amyl alcohol,[59] ethyl alcohol,[60] glycols[61] and glycol ethers.[62] Triethanolamine soaps and fatty acid esters of polyhydric alcohols containing at least one free hydroxyl group (e.g., glycol monolaurate) are also used. In many cases the addition of water is also necessary,[63] thus a miscible oil is a three or four component system.[64]

The pH of "soluble" oils usually is between 7 and 9.

Cutting fluids are used both to cool and to lubricate. When lubrication is important it is generally recognized that fatty oils are superior to mineral oils.

Detergent Emulsions

A detergent acts by suspending foreign matter in a liquid or foam. It floats off the "dirt."

A detergent should reduce the surface tension of water and ameliorate the contact with the material to be cleaned. If the dirt is water-repellent, water alone cannot remove it and the application of an emulsion will be necessary.

Where the dirt is enclosed or imbedded in oil, fat, and the like, emulsifying action is necessary. Addition of alkalies, within certain limits is often helpful,[65] as well as the addition of solvents.

Difficulty in removing mineral oil from wool with soap and soda is attributed to the great adhesive power between the oil and wool. This adhesion may be reduced by the addition of long-chain aliphatic alcohols, e.g., oleyl alcohol, or cetyl alcohol sulfate.[66] The use of 6% oleyl alcohol seems to be optimal. Greater amounts hinder oil removal.[67]

Food Emulsions

Both natural and man-made emulsions serve as foods in numerous instances. Natural emulsions are typified by cream and milk. Man-made edible emulsions are exemplified by mayonnaise, salad dressing and shortening.

If the proportion of oil to egg or to emulsion already produced is kept below a certain maximum, a stable emulsion always results regardless of temperature or manner of beating. If the proportion of oil exceeds a certain minimal proportion, the egg or emulsion already produced always becomes dispersed in the oil and no permanent emulsion is formed. If proportions between the limits are used the formation of a permanent emulsion depends upon such variables as temperature and method of beating. If the egg is previously diluted with vinegar the proportion of oil which can be emulsified is greatly increased during the first and second additions of oil, but with increase in viscosity the maximum ratio of oil to emulsion rapidly approaches the value obtained when egg is used alone.[68]

Mayonnaise is a typical edible emulsion. It consists of a dispersed phase (vegetable oil), a continuous phase (water), emulsifying agents (egg yolk and mustard and vinegar) and/or other flavoring materials. Egg yolk is the most efficient edible emulsifying agent for O/W emulsions. Its lecithin content tends to produce O/W emulsions, whereas its cholesterol tends to the opposite type.[69,70] Any change in the proportions of lecithin and cholesterol will affect the stability or type of emulsion.[71] This is probably why fresh egg yolk is more efficient than the frozen product in which the lecithin is partially hydrolyzed. Lecithin always undergoes hydrolytic changes on aging and thus will vary in its action. Cholesterol is relatively stable.[72]

In mayonnaise manufacture, a pre-mix of all the oil, emulsified in a small part of the aqueous phase, is added to the rest of the aqueous phase. The great ratio of oil to water would tend to make the W/O type, but the emulsifying agent prevents this. The reason for this method is that it produces a high viscosity which permits better mixing and the use of a smaller amount of emulsifier. Mayonnaise and certain other types of oil-rich emulsions are not homogenized because such treatment may break the emulsion.

Powdered mustard is used in mayonnaise to prevent the formation of lime soaps, when hard water is used, with resultant W/O type formation.[73]

Breaking of mayonnaise and dressing may be due to: (1) wrong proportions of oil, water and egg (best proportions are 78, 17, 5); (2) too rapid addition of oil; (3) wrong type of agitation; (4) effect of heat; (5) freezing; (6) addition of alum (as in pickle relishes); (7) hydrolysis or bacterial decomposition of starch; (8) evaporation of water.

Shortening is a W/O emulsion of edible oil or fat used in baking. Many emulsifiers have been used, e.g., polymerized or oxidized glycerides of unsaturated fatty acids.[74]

Lacquer Emulsions

Lacquer can be made by any customary method. The most useful concentration ratio is 2½ parts of lacquer to 1 part of water phase.

Stability generally varies with particle size, all other variables being constant.

Poor emulsions result from rapid stirring with a high-speed mixer. The results are greatly improved by using the stator-rotor type sheering action of a colloid mill. The most stable emulsions are usually produced by high pressure extrusion, i.e., in an homogenizer. For easily dispersed systems, an homogenizer alone is sufficient. Systems which are difficult to disperse must be predispersed by other types of equipment, e.g., colloid mill, before passing through the homogenizer. Almost any good emulsifying agent, and this includes soap, will form some type of an emulsion with a lacquer. Useful stabilities, and this means three months or better, can only be realized by a careful selection of the emulsifier. One of the best contains 0.5% Dupanol, 1.0% sulfonated castor oil either alone or mixed with other emulsifiers or lacquer solvents.

Lacquers rich in resins are more easily dispersed than those that are nitrocellulose rich and as a rule have a longer life.

Lacquer emulsions have high flash points and are usually broken by freezing. Lacquers of very high viscosity are difficult to disperse.

Latex Emulsions

Rubber latex coming from various species of plants possesses different properties. Most of the latices are dispersions rather than emulsions.[75] The percentage of rubber in natural latex, usually is 35–40. A natural protein is present as a stabilizer.

Latex is concentrated by inducing creaming and removing the cream layer mechanically. Certain emulsifiers accelerate creaming of rubber latex emulsions, e.g., Irish moss,[76,77,78] gum tragacanth,[79] pectin,[80] gelatin,[81] ammonium alginate,[82] agar, and casein.[83] Creaming is also hastened by centrifuging,[84] application of low electrical potentials,[85] evaporation after addition of soap,[86] addition of alcohol.[87] Saponin stabilizes the cream layer.[88]

Concentrated latex, having a larger percentage of protective colloid, is usually more stable than normal latex.

Hevea latex becomes acid on standing and coagulates. Ammonia is usually added to prevent this. Such preserved latex may be coagulated with salts (aluminum sulfate) while still alkaline.[89] Sodium silicofluoride, hydrophilic materials, e.g., alcohol, acetone, carbon-black, cement will achieve the same effect.

Leather Emulsions

In the manufacture of leather, dilute O/W emulsions, called fat-liquors, are in use. They contain vegetable, animal or mineral oils, sometimes combined with waxes. The emulsifiers are soaps or sulfonated oils.

Emulsions used in the manufacture of leather may contain: Oil with glue or gum; gum and starch;[90] sodium glycerophosphate;[91] neatsfoot oil with aluminum hydroxide;[92] oil with esters of sulfo-fatty acids and albumin or glue;[93] oil with tertiary or quaternary amine salts;[94] oil with methyl cellulose;[95] oil with lecithin;[96] and oil with bentonite.[97]

Medicinal Emulsions

The most commonly used medicinal emulsions are those of highly refined viscous mineral oil and cod liver oil.

Improved methods for making pharmaceutical, emulsions of turpentine, paraffin oil and other oils are given by Hall.[98]

Ointments containing a fatty component, water and medicaments, e.g., mercury salts, sulfur, iodine, may be classified as medicinal emulsions also.

Toxic doses of diphtheria and tetanus toxin may be safely injected subcutaneously if they are emulsified in a finely dispersed O/W emulsion (5% olive oil in 0.2% solution of sodium oleate and brought to pH 8 with sodium carbonate).[99]

Paint Emulsions

Most emulsion paints are O/W emulsions carrying a pigment. The stabilizer is usually a protein (casein or glue), and the oil phase (varnish) is of high viscosity. The emulsifier may be soap or a sulfated product. The warm oil is usually added to the water containing the protein and soap. Emulsification proceeds smoothly on mixing and the water-wetted pigment is dispersed in the aqueous phase. The emulsion may be slowly diluted with water before use.[100]

Breaking of paint emulsions is often due to shaking during transportation or to too vigorous mixing before application with the brush. This is due to penetration of pigment particles into the protective oil layer and their being wetted by the oil phase. Aging of the emulsion before pigmentation often improves stability.

Certain emulsion paints are of as good quality as non-emulsion paints; they are more economical; and have equal covering power. The W/O type is superior; the inclusion of oxidized instead of raw oils is preferable; and less than 25% water should be used. These emulsion paints can be used indoors or outdoors when properly made, but they are not recommended for unprimed iron.[101]

The amount of emulsifier determines the type of paint emulsion. Using 0.25–6% ethanolamine or triethanolamine soap gives W/O emulsions while 10% gives O/W emulsions.

Polish Emulsions

Emulsion shoe polishes consist of mixtures of waxes, with or without solvents, emulsified with alkalies. Potassium carbonate is preferred as an alkali because it gives more uniform dispersions. It is necessary to use only a small amount of alkali to saponify part of the fatty acid contained in the wax. This then acts as an emulsifier for the rest of the wax. Soap is often added as an auxiliary emulsifier because of its bodying and lubricating effect, and especially when using waxes containing little or no free fatty acid.

A typical procedure is to dissolve the soap, alkali, water and soluble dye in boiling water in the foregoing order and then add the melted waxes, resins and solvents slowly with good mixing. Heating is continued until all the carbon dioxide gas has been eliminated and until the emulsion is homogeneous. Containers are best filled at the lowest possible temperature (just above the setting point), and containers should be allowed to cool uniformly and not be disturbed until their contents have solidified.

Sodium carbonate gives harder products that will hold larger percentages of water. Potassium carbonate is preferred because the finished product made with it has less tendency to shrink and contract. Borax, ammonia and organic amines are also used as alkalies to obtain special polishes.

Floor, furniture and automobile polishes are essentially very similar to shoe polishes except that they are more fluid. While formulation is different, their method of manufacture is the same.

Transparent Emulsions

Transparent emulsions are made by adjusting the refractive indices of the phases.[102] Carbon tetrachloride and glycerol are suitable liquids for raising refractive indices.[103] Concentrated invert sugar and sucrose solutions may also be used for this purpose. These transparent emulsions can be made very stable by proper formulation and technique. Coconut oil ethyl ester is suitable for lowering refractive indices of oil.

Glycerin and tartaric acid are used for increasing refractive indices of sugar solutions.

Transparent emulsions of orange, peppermint, lemon, lime and rose oils can be made with gelatin, gum arabic, gum tragacanth or agar-agar as emulsifier.

Agar-agar and tragacanth have sometimes proved unsatisfactory as emulsifiers.[104] The problem of graining may be solved by employing a mixture of two parts invert sugar and one part sucrose, instead of straight invert sugar in the dispersion medium. The colloid mill is indispensable in the preparation of this type of dispersion.

Wax Emulsions

Stable wax emulsions, usually have a uniform particle size of about 10^{-4} cm.

Most troubles in making wax emulsions are caused by specks or clumps of incompletely melted or chilled wax. It is, therefore, essential that a sufficiently high temperature of both phases be maintained during the emulsification to avoid such difficulties.[105]

REFERENCES

[1] Van der Heide, German Patent 482,919 (1926).

[2] Dubbs and Morrell, U. S. Patent 1,744,109 (1930); U. S. Patent 1,970,996 (1934).

[3] *Ind. Eng. Chem.*, **25**, 1338 (1933).

[4] I. C. I. Ltd., British Patent 313,252 (1928).

[5] Crawford and Schoenfeld, U. S. Patent 1,191,775 (1933).

[6] Gas. Fuel Corp., French Patent 744,602 (1933).

[7] Vance, U. S. Patent 1,926,071 (1933).

[8] Barbieri, U. S. Patent 2,078,555 (1939).

[9] I. G., French Patent 845,661 (1940).

[10] Kobe, *Ind. Eng. Chem.*, **31**, 262 (1939).
[11] King, *J. Soc. Chem. Ind.*, **57**, 431 (1930).
[12] Stiansy, *Collegium*, p. 230 (1928).
[13] Arnoldi, *Collegium*, p. 292 (1928).
[14] Eilers, *Chem. Weekblad*, **35**, 129 (1938).
[15] Woodman, *J. Phys. Chem.*, **33**, 88 (1929).
[16] *T. A. Gardeners Monthly (Eng.)*, p. 11 (Jan. 1868).
[17] Cruickshank, *T. A. Gardeners Monthly (Eng.)*, p. 45 (Feb. 1875).
[18] Cook, *Mich. Agr. Exp. Sta. Bull.*, 58 (1890).
[19] Lodeman, *Spraying of Plants*, p. 153, (1902).
[20] Del Gueres, *F. Pflanzenkrakh*, **4**, 4 (1894).
[21] Personal Communication.
[22] Ginsburg, *J. Econ. Entomol.*, **26**, 566 (1933).
[23] Headlee, *N. J. Agr. Exp. Sta. Bull.*, 469 (1929).
[24] Newcomer, *U. S. Dept. Agr. Tech. Bull.*, 281 (1932).
[25] Batchelder, *J. Econ. Entomol.*, **24**, 1152 (1931).
[26] Tower, U. S. Patent 1,869,562 (1932).
[27] Woodman, *J. Pomol. Hort. Sci.*, **4**, 78 (1925).
[28] Penny, *J. Econ. Entomol.*, **14**, 428 (1921).
[29] *Agr. Gaz. N.S.W.*, **35**, 290 (1924).
[30] Takashima, *J. Pub. Hlth. Japan*, **3**, 1 (1927).
[31] Hartzell, *N. Y. Agr. Exp. Sta. Bull.*, 636 (1933).
[32] Staniland, *Long Ashton Ann. Rept.*, p. 78 (1926).
[33] Lodeman, *Spraying of Plants*, p. 78 (1902).
[34] Ginsburg, *J. Econ. Entomol.*, **28**, 599 (1932).
[35] Pipal, *Indiana State Bull.*, 176 (1914).
[36] Woodman, *Chem. News*, **144**, 21 (1932).
[37] Woodman, *J. Soc. Chem. Ind.*, **60**, 91T (1931).
[38] Johnson, *Calif. Agr. Exp. Sta. Bull.*, 528 (1932).
[39] *Japan. J. Eng.*, **17**, 7 (1939).
[40] Khim, *Ref. Zhur.*, **11**, 119 (1939).
[41] Kozi Doi, Japanese Patent 129,057 (1939).
[42] *Technical Aspects of Emulsions*, p. 136.
[43] Montgomerie, British Patent 226,032.
[44] MacKay, British Patent 202,021.
[45] Rick, *Teer u. Bitumen*, **32**, 113 (1934).
[46] Ebberts, *Rock Products*, **33**, 53 (1930).
[47] Becker, *Bitumen*, **11**, 38 (1941).
[48] Neubronner, *Teer u. Bitumen*, **32**, 211 (1934).
[49] Leemans, *Chem. Weekblad*, **26**, 2 (1929).
[50] Miscall, *Chem. Met. Eng.*, 37 (1930); Kirshbaum, U. S. Patent 1,918,759 (1933).
[51] Preaubert, British Patent 9,422 (1905).
[52] Personal Communication.
[53] Nussell, *Bitumen*, **11**, 45 (1941).
[54] Jannaway, *Perfumery Essent. Oil Record*, **30**, 45 (1939).
[55] Schimmel, *Am. Perfumer*, 32 (October 1941).
[56] Hart, *Ind. Eng. Chem.*, **21**, 85 (1929).
[57] Woodman, *J. Agr. Soc.*, **17**, 44 (1927).
[58] Woodman, *J. Pomology, Hort. Sci.*, **5**, 43 (1925).
[59] Woodman, *J. S. C. I.*, **49**, 93T (1930).

[60] Melander, *Wash. Agr. Exp. Sta. Bull.*, 197 (1926).
[61] Personal Communication.
[62] Personal Communication.
[63] Personal Communication.
[64] *Technical Aspects of Emulsions*, p. 85, 1936.
[65] Hannay, *J. Soc. Dyers Colourists*, **50**, 273 (1934).
[66] Speckman, *Trans. Faraday Soc.*, **29**, 358 (1933).
[67] *Technical Aspects of Emulsions*, p. 104, 1936.
[68] Mark, *J. Home Econ.*, **13**, 447 (1921).
[69] Seifriz, *Am. J. Physiol.*, **56**, 124 (1923).
[70] Bhatnagar, *J. Chem. Soc.*, 119, 1760 (1921).
[71] Corran, *Biochem. J.*, **18**, 1368 (1924).
[72] *Technical Aspects of Emulsions*, p. 91.
[73] *Food Manufacture*, **1**, 17 (1934).
[74] Schou, U. S. Patent 2,220,976 (1940).
[75] *Technical Aspects of Emulsions*, p. 121.
[76] *Biochem. Z.*, **149**, 525 (1924).
[77] British Patent 226,440 (1924) ; U. S. Patent 1,754,842 (1930).
[78] K.D.P., British Patent 237,269 (1929) ; French Patent 686,821 (1929) ; Westcott, U. S. Patent 1,754,535 (1930).
[79] Johnson, British Patent 286,527 (1927).
[80] McGarack, U. S. Patent 1,647,805 (1927) ; Pektinges, Ger. 560,259 (1923).
[81] Banks, U. S. Patent 1,755,279 (1920).
[82] General Rubber, British Patent 294,002 (1927).
[83] Loomis, U. S. Patent 1,816,018 (1932).
[84] Westcott, U. S. Patent 1,754,535 (1930).
[85] McGarack, British Patent 344,647 (1929) ; U. S. Patent 1,921,575 (1933).
[86] *Technical Aspects of Emulsions*, p. 126.
[87] Stevens, British Patent 415,133 (1933).
[88] Teague, U. S. Patent 1,772,647 (1930) ; Nikitin, U. S. Patent 1,880,975 (1932).
[89] *Technical Aspects of Emulsions*, p. 125.
[90] Rohm, British Patent 353,846 (1929).
[91] Rohm, U. S. Patent 1,981,363 (1932).
[92] Rohm, U. S. Patent 1,751,217 (1930).
[93] Bohme, A. G., British Patent 313,966 (1928).
[94] Somerville, U. S. Patent 1,883,042 (1932).
[95] I. G., German Patent 524,211 (1926).
[96] Bollman, German Patent 414,399 (1927).
[97] Progil, French Patent 742,563 (1933).
[98] Hall, *Pharm. J.*, **135**, 133 (1935).
[99] Walsh and Frazer, *Brit. Med. J.*, March 10, 1934.
[100] Khim, *Referat. Zhur.*, **8**, 103 (1939).
[101] Khim, *Referat. Zhur.*, **11**, 109 (1939).
[102] Rector, U. S. Patent 1,389,161 (1921) ; Whatmough, U. S. Patent 1,663,323 (1928).
[103] Holmes, *Introductory Colloid Chemistry*, p. 82, 1934.
[104] Whitmore, *Ind. Eng. Chem.*, **21**, 878 (1922).
[105] Billings, *Am. Dyestuff Reptr.*, May 16, 1938.

CHAPTER VII

DISPERSING AGENTS AND WETTING AGENTS

Dispersing Agents

A DISPERSING agent is a compound which separates aggregations of particles by reducing the cohesive attraction between them. A dispersing agent may have but little effect on the surface tension. Consequently, its wetting properties may be negligible. Its action is very specific, working well in some systems and not in others. A dispersing agent may be either inorganic or organic.

In very adhesive products, e.g., coagulated latex, mechanical force is often necessary before the dispersing agent can exert its action.

Protective colloids should not be used with dispersing agents as they interfere with each other. This caution also applies to using wetting agents with dispersing agents.

The following are a few materials that are being used commercially as dispersing agents:

Darvan;[1] Daxad[2]
Glaurin[3]
Glycol Naphthenate[3]
Hornkem[4]
Sodium Lignin Sulfonate[5]

Wetting Agents

Wetting agents are generally materials which, in small amount, greatly reduce the surface tension of water and lower the interfacial tension between water and another contacting surface. A good wetting agent decreases the surface tension to 30 dynes per cubic centimeter or less in solution. Interfacial tension is the surface tension at the interface (region of contact) between two immiscible phases. This region may be liquid and air, liquid and a solid, or two liquids.

There seems to be considerable confusion as regards the terms *wetting* and *dispersing*. As stated previously, a wetting agent is a material which will reduce the surface tension of water and lower the interfacial tension. On the other hand, a true dispersing agent usually has little effect on the surface tension of water. An aqueous dispersing agent is a material which promotes the separation or deflocculation of particles. This is accomplished by overcoming the adhesive forces between the individual particles.[6]

Wetting agents usually contain both polar and non-polar groups. The following table[7] gives their characteristics. The polar group has an affinity for water and water-soluble materials and the non-polar group prefers oily and water-insoluble materials. The balance of these two groups and their positions in the molecule determine the compound's characteristics.

POLAR-NON-POLAR COMPOUNDS

Polar (Salt)	*Non-polar (Mineral Oil)*
Ionized	Non-ionized
High dielectric constant	Low dielectric constant
High melting point	Low melting point
Soluble in water	Insoluble in water
Insoluble in organic solvents	Soluble in organic solvents
Melt conducts electricity	Melt does not conduct electricity

Many varieties of wetting agents are available and used for different purposes under different conditions. The most commonly used method of evaluation is that of Draves-Clarkson.[8] It consists of measuring the time necessary for a five-gram skein of unboiled two-ply cotton yarn to sink in a definite concentration of a wetting agent in water at a definite temperature.

Anion surface-active compounds have a negative charge on the surface-active or non-polar group. On electrolysis of a solution of such a compound the latter group goes to the anode.

Cation-active compounds are those whose cation is the effective agent. On electrolysis of a solution of such a compound, the active non-polar group travels to the cathode. Compounds in this class are the quaternary ammonium salts, sulfonium and phosphonium compounds, If anion- and cation-active compounds are mixed they tend to form a precipitate by mutual neutralization of their charges.[9]

Non-ion-active compounds are those emulsifiers acting in non-ionized form, e.g., nonaethylene glycol laurate or Emulgor A.[10]

As the length of the polar chains is reduced, the solubility is increased. It is noted that the sodium salt of the dioctyl ester of sulfosuccinic acid is soluble to the extent of approximately 1.5% and that as the length of the polar chain is reduced still further, the solubility is further, though not markedly, increased. However, in doing so, the wetting power is adversely affected in ordinary water. For example, the sodium salt of the dibutyl ester of the sulfonated dicarboxylic acid has no wetting power in ordinary water at a concentration of 1%.[11]

Wetting intensity and the formation of a protective interfacial film are not always proportional.

Wetting agents are specific. One agent may work well in the presence of a hydrophobic material and not with a hydrophilic material. Therefore, the statement that a substance is a good wetting agent is incomplete unless the exact nature of the surface or interface is indicated.[12]

Octyl alcohol can be used as a wetting agent in the following proportions (by volume): [13]

(a) Pigments in water or oil base paints, use 0.02–1.0% of weight of pigment.
(b) Pigments in water base cosmetic lotions, use 0.001–0.01%.
(c) Pottery casting clays to increase "slip" and remove air bubbles, use 0.0001–0.001% of "slip."
(d) Leather dressings, spray 0.002–0.02% onto pigment before water is added.
(e) Pigments in lacquers, use 0.1–1.0% of weight of pigment.
(f) Penetrating oils, use approximately 1.0%.[9]

Some of the more commonly used wetting agents are the soluble salts of sulfated higher fatty alcohols, sulfonated amides, fatty acid ester sulfonates, sulfonated ethers, alkyl aryl sulfonates and polyhydroxy alcohols partially esterfied with higher fatty acids. A partial list of surface-active agents follows:

COMMERCIAL SURFACE-ACTIVE AGENTS

Product	*Composition*
Aerosol AY	Diamyl ester of sodium sulfosuccinic acid
Aerosol 1B	Dibutyl ester of sodium sulfosuccinic acid
Aerosol MA	Dihexyl ester of sodium sulfosuccinic acid
Aerosol OS	Alkyl aryl sulfonate
Aerosol OT	Dioctyl ester of sodium sulfosuccinic acid
Ahco Penetrant L	Alkyl aryl sulfonate
Alframine DCA	Sulfated glycerylamide
Aliphatic ester sulfate	Oil ester sulfate
Alkamine W	
Alkanol B, SA, HG.	Sodium alkyl naphthalene sulfonate
Alkanol S	Sodium tetrahydronaphthalene sulfonate
Amalgol	
2-Amino-1-butanol	Fatty acid soaps
2-Amino-2-ethyl-1,3-propanediol	
2-Amino-2-methyl-3-hexanol	
2-Amino-2-methyl-1,3-propanediol	
2-Amino-2-methyl-1-propanol	
Anthrapole	Sulfonated oil + solvents
Appretole	Glyceryl sulforicinoleate
Arctic Syntex A	Oleic acid ester of sulfonated aliphatic compound
Arctic Syntex M	Sulfate of mixed fatty acid monoglycerides
Arctic Syntex T	$C_{17}H_{33}CONH\text{-}C_2H_4\text{-}SO_3Na$
Areskap	Monobutyl phenyl phenol sodium monosulfonate
Aresket	Monobutyl diphenyl sodium monosulfonate
Aresklene	Dibutyl phenyl phenol sodium disulfonate

Product	*Composition*
Aromine PM	Organic sulfonate + solvents
Arylene	Sulfonated aromatic
Avitex AD	Fatty alcohol sulfate
Bensapol	Sulfonated oils + solvents
Betasol OT-A	Sulfonated ester of dicarboxylic acid
Bozetol	Sulfonated castor oil derivative
Burkol	Organic sulfonate
C.A.C. 2720	Phosphorated amine
Calgon	Sodium hexametaphosphate
Cominol	Derivative of higher sulfonated alcohol
Cresol	$C_6H_5OH-CH_3$
Cyclohexanol	Hydrogenated phenol
Daconol	Alkyl aryl sodium sulfonate
Darvan	Polymerized organic salts of alkyl aryl sulfonic acids
Daxad	Polymerized organic salts of alkyl aryl sulfonic acids
Deceresol OT	Dioctyl ester of sodium sulfosuccinic acid
Detanol	Derivative of higher sulfonated alcohol
Diethylenetriamine Soaps	
Diglycol Laurate	
Dilex	Purified sulfo-lignin
Dipex	Water-soluble sulfonated mineral oil
Dreft	Fatty alcohol sulfate
Drene	Fatty alcohol sulfate
Duponol D, LS	Fatty alcohol sulfates
Duponol 80, WA, ME Dry PC Special WA	Fatty alcohol sulfates
Duponol G, OS, WS	Fatty alcohol sulfates
Elemite	Sulfonated oils + solvents
"Emulgor A"	Polymerized ethylene glycol ester
Gardinol LS, WA, Special WA	Fatty alcohol sulfate
Glyceryl Monostearate	
Halo	Sulfate of mixed fatty acid monoglycerides
Hamico 169	Sulfonated ester
Hartex Oil K-40	Sulfonated oils + solvents
Hartex Oil L-33	Glycol soaps + alkali
Hartolein K-122	Pine oil soap + alkali

Product	*Composition*
Hartopene	Pine oil gel
Hornkem 1	Processed waste sulfite liquor
Hornkem 3	Hornkem 1 + wetting agents
Hornkem 31	Processed waste sulfite liquor
Hydroxyethyl ethylene diamine Soap	
Igepal C	Polymerized ethylene oxide condensate
Igepon AP Extra	Oleic acid ester of long chain aliphatic
Igepon T	$C_{17}H_{33}CONHC_2H_4SO_3Na$
Integritol	Mixed sulfonated oils, esters, alcohols
Intramine	Sodium salt of sulfonated lauryl and myristyl collamide
Invadine B.C.N.	Sodium alkyl phenylene sulfonate
Lamepon A	Protein fatty acid condensate
Lamepon 4C	Protein fatty acid condensate
Lamepon 10-N	Protein fatty acid condensate
Lanitol P	Sodium alkyl aryl sulfonate
Lanitol S	Sodium alkyl aryl sulfonate + alkali
Lanole B	Sodium oleate + solvents
Lauramine	
Leonil SA	Naphthalene sulfonic acid derivative
Loupene	Sulfonated oils + solvents
Loupole W-950	Sulfonated oils + solvents
Maprofix	Sulfated fatty alcohol
Mapromin	Sulfated fatty alcohol
Mapromol	Sulfated fatty alcohol
Mercerol	
Merpentine	Sodium alkyl naphthalene sulfonate
Merpol B.C.	Alcohol sulfate
Methylcyclohexanol	
Modinal D, ES	Fatty alcohol sulfate
Monostearin	Glyceryl monostearate, special
Monosulph	Sulfonated castor oil
Naccolene F	Modified alkyl aryl sulfonate
Nacconol E	Sodium alkyl aryl sulfonate
Nacconol EP	Sodium alkyl aryl sulfonate
Nacconol NR	Sodium alkyl aryl sulfonate
Nacconol NRNO	Sodium alkyl aryl sulfonate

Product	*Composition*
Nacconol NRSF	Sodium alkyl aryl sulfonate
Naccosol A	Sodium alkyl naphthalene sulfonate
Nekal A, BX	Sodium alkyl naphthalene sulfonate
Neomerpin N	Alkyl naphthalene sulfonic acid
Neomerpin VD	Sodium alkyl naphthalene sulfonate
Nonaethyleneglycol oleate	
Nopco 1935	Sulfonated oil, vegetable type
Nopco 1967	Sulfonated alkyl hydrocarbon
Nopco DID	Sulfonated fatty amine
Novonacco	Modified sodium alkyl naphthalene sulfonate
Novonacco NN	Modified alkyl naphthalene sulfonic acid
N.S.A.E.	Alkyl naphthalene sulfonic acid ester
Nusope 33A, P50	Alkali soap of naphthenic acids
Oleo Glyceryl Sulfate C, O	Oil ester sulfate
Onyxol 66	Oil ester sulfate
Orthocen	Sulfonated higher phenol
Orvus	Fatty alcohol sulfate
Para Oil	Saponified oils
Pemeko	Sulfated alcohol
Penetrolin AC	Sodium salt of alkylated naphthalene sulfonic acid
Pentogen	Sulfated compound containing solvents
Phi-ϕ-Sol	Sulfonated oil ester
Phi-ϕ-Sol W.A.	Sulfonated oil ester
Pineol	Sulfonated oil + terpenes
Pyridine	
Quadrafos	
Sodium tetraphosphate	
Quaker 3-X	Sulfonated pine oil
Quaker 700-X	Sulfonated cresylic compound
Quaker Dianol D	Combination sulfonated higher alcohol and aldehyde condensates
Quaker Pro-So-Tex 55	Aromatic sodium sulfonate
Quaker Pro-So-Tex 58	Sulfonated petroleum derivative
Quaker Pro-So-Tex 75	Alkylated aryl sulfonate
Quix	Sulfonated fatty acid

Product	*Composition*
Quixite	Sulfonated fatty acid
Radiactine	Algin soap compound
Rapidole H	Saponified sulfonated vegetable oils + solvents
Royox	Pine oil with soap
Sandozol G	Sulfonated fat
Sanol 1, S, T	Sulfonated aryl alcohols
Santomerse	Alkylated aryl sulfonate
Sapamine A	Diethyl aminoethyl oleyl amide acetate
Soapotol	Sulfonate derivative of higher alcohol
Solvadine NC Conc.	Alkylated aryl sulfonate
Stablex A	Naphthalene sulfonate
Stablex G	Petroleum sulfonate
Sulfanole K	Fatty amide sodium sulfonate + solvents
Sulfanole PB	Fatty amide sodium sulfonate
Sulfatate	Sulfonated hydrocarbon
Sulfonated Luxolene	Fatty ester sulfonate
Supergel T.B.	Soluble terpene sulfonate
Supersulfate F.S. Powder	Sulfated aryl alcohol
Surpasol	Mixture of sulfonated oils, esters, alcohol
Teel	Fatty alcohol sulfate
Tenesol A, B, C, D, F concentrates	Sulfonated ethers
Tensol	Sulfonated ethers
Tergitol Penetrant 4,7	Sodium salt of higher secondary alkyl sulfate
Tergitol Penetrant 08	Sodium salt of higher primary alkyl sulfate
Tergitol Penetrant 4T	Amine salt of higher secondary alkyl sulfate
Tetraethylene Pentamine Soaps	
Tetranol 1638	Sulfonated fatty ester
Tinapol Oil NE	Sulfonated ester
Tris (hydroxymethyl) aminomethane Soap	
Triton 720	Sulfonated ether
Triton 812	Condensed sulfonated ether
Triton E-40	Salt of sulfonated and sulfated ether
Triton E-79	Amine salt of sulfated ether

Product	*Composition*
Triton K-12	Quaternary ammonium salt
Triton K-60	Quaternary ammonium salt
Triton NE	Organic polyether alcohol
Triton W-30	Sulfated aromatic ether alcohol
Twitchell Base 262	Sodium sulfonates of mineral oil
Twitchell Base 265	Sodium sulfonates of mineral oil
Twitchell Oil 3X	Sodium sulfonates of mineral oil
Ultravon K, W	Sulfonated complex stearyl alkyl compound
Ultrawet 40, 4D (+ sodium sulfate)	Aromatic monosodium sulfonate
Ultroil	Sulfonated vegetable oil
Unitex	Alkylated aromatic sulfonate
Vel	Sulfate of mixed fatty acid monoglycerides
W. A. 35A, B, C	Phosphorated higher alcohol $(octyl)_5Na_5P_6O_{20}$
W. A. 58	Phosphorated higher alcohol $(capryl)_5Na_5P_6O_{20}$
Warcosol	Alkyl naphthalene sodium sulfonate
Warcosol 897	Hydrocarbon sodium sulfonate + solvent
Wetanol	Modified sulfated fatty acid ester
Wetonite	Sulfonated ester
Wetsit	Alkylated aromatic sulfonate
Xynomines	Sulfated boro-fatty acid amide
Yelkin C	Water-dispersible lecithin
Yelkin T	65–70% lecithin 30–35% soybean oil
Yelkin T-X15	Lecithin compound

REFERENCES

[1] R. T. Vanderbilt Co., New York, N. Y.
[2] Dewey and Almy Chem. Co., Cambridge, Mass.
[3] Glyco Products Co., Inc., Brooklyn, N. Y.
[4] A. C. Horn Co., Long Island City, N. Y.
[5] Marathon Chemical Co., Rothschild, Wisc.
[6] Wetting Agents, Their Structure, etc., *Paper Trade J.* (August 1940).
[7] Christmann, Am. Cyanamid Co. Tech. Paper 17 (1930).
[8] Draves, *Am. Dyestuff Reptr.*, **28**, 425 (1939).
[9] Dhingra, *J. Soc. Dyers Colourists*, **53**, 91 (1937).
[10] Glyco Products Co., Inc., Brooklyn, N. Y.
[11] Wetting Agents, Their Structure, etc., *Paper Trade J.* (Aug. 22, 1940).
[12] Bartell, *Ind. Eng. Chem.*, **31**, 31 (1939).
[13] Bennett, *Chem. Formulary*, Vol. 4, 100, 1939.

CHAPTER VIII

List of Emulsifying Agents

Abrocol (glyceryl monostearate)[1]
Acimul (modified glyceryl monostearate used with weak acids)[2]
Agar[3]
Agar, pectin and gelatin[4]
Albasol (sulfonated fats)[5]
Albatex BD (sodium m-nitrobenzene sulfonate)[6]
Albumin[7]
Albumol (complex albuminoid)[8]
Aldol urea reaction products[9]
Algin[10]
Alginic acid or sodium alginate[11]
Alkyl or aromatic esters of petroleum sulfonates[12]
Alkyl guanidine[12a]
Alkyl sulfates of high molecular weight[13]
Alkylaminoethane sulfonic acids[14]
Alkylene oxides, polymerized[15]
Alkylolamine esters, polymerized (e.g., polymerized triethanolamine)[16]
Alronol 90 (propylated amines)[17]
Alumina[18]
Alumina, activated gelatinous[19]
Alumina, powdered, or iron oxide gels[20]
Aluminum or calcium naphthenates[21]
Aluminum oxide, hydrated[22]
Aluminum palmitate[23]
Amide, acid[24]
Amide, borated alkyl-[25]
Amide, castor oil[26]
Amide, coconut oil[27]
Amide, oleic[28]
Amide, sperm oil[29]
Amide, stear-[30]
Amide, stearyl monoglycol[31]
Amide of substituted fatty acid[32]
Amide, sulfated alkyl-[33]
Amide, wool fat[34]

Amido fatty acid and sodium salts of their sulfates[35]
Amine, amidostearyl diethylene-[36]
Amine, castor oil[37]
Amine, coconut oil[38]
Amine, dibutyl-[39]
Amine, di-2-ethylhexyl-[40]
Amine, di-2-hydroxyethyl-[41]
Amine, dioctyl-[42]
Amine, ethylenedi-[43]
Amine, monoamyl-[44]
Amine, monobutyl-[45]
Amine, oleic[46]
Amine, tributyl-[47]
Amine, triethanol[48]
Amine, tri-2-hydroxyethyl[49]
Amine, triisopropanol[50]
Amino-alcohol and synthetic resin acid reaction product[51]
Amino alkyl phosphatidic acids[52]
2-Amino-2-ethyl-1, 3-propanediol[53]
2-Amino-3-hexanol[54]
2-Amino-2-isopropyl-1, 3-propanediol[55]
2-Amino-2-methyl-1-butanol[56]
2-Amino-2-methyl-3-hexanol[57]
2-Amino-2-methyl-1, 3-propanediol[58]
2-Amino-2-methyl-1, 3-propanediol oleate[59]
2-Amino-2-methylol-1, 3-propanediol stearate[60]
2-Amino-2-methyl-1-propanol[61]
2-Amino-1-pentanol[62]
2-Amino-2-propyl-1, 3-propanediol[63]
3-Amino-4-heptanol[64]
3-Amino-3-methyl-2-butanol[65]
3-Amino-2-methyl-4-heptanol[66]
3-Amino-3-methyl-4-heptanol[67]
3-Amino-3-methyl-2-pentanol[68]
Amino mineral oil sulfonate[69]
5-Amino-4-octanol[70]
Aminostearin (modified amine soap)[71]
Ammonium laurate, anhydrous[72]
Ammonium laurate, conc., S[73]
Ammonium laurate S[74]
Ammonium linoleate[75]
Ammonium linoleate paste S[76]
Ammonium oleate[77]
Ammonium resinate[78]
Ammonium salt of sulfonated shale oil[79]

Ammonium salts, long-chain quaternary, e.g., ammonium chloride and water-soluble cellulose ethers [80]
Ammonium salt of phosphated castor oil [81]
Ammonium shale oil sulfonate [82]
Ammonium stearate, anhydrous [83]
Ammonium stearate paste S [84]
Ammonium sulfoicthyolate [85]
Ammonium sulfoleate [86]
Ammonium sulfonates [87]
Amoa (reaction product of caustic potash or casein)[88]
Antimony trichloride [89]
Aqualoid (lecithin hydrate and 10% alcohol)[90]
Aquamel (animated hydrocarbon)[91]
Aquaphil [92]
Aquasol (highly sulfonated castor oil)[93]
Arctic Syntex A (oleic acid ester of an aliphatic compound sodium sulfonate)[94]
Arctic Syntex T $(C_{17}H_{33}.CO.NCH_3.C_2H_4SO_2Na)$[95]
Areskap (neutral salt of sulfonated butyl diphenyl compound)[96]
Aresket (neutral salt of sulfonated butyl diphenyl compound)[97]
Aresklene (neutral salt of sulfonated butyl diphenyl compound)[98]
Arkol base (olive oil emulsifying base)[99]
Asphalt [100]
Asphalt resin or petroleum tar [101]
Barium oleate [102]
Base 2210 (naphthenic and petroleum sulfonate soap)[103]
Betramine (sulfonation product of a high molecular aliphatic aldehyde condensation)[104]
Bile [105]
Blendene [106]
Blood albumin, casein or other protein, hydrolyzed and treated with alkali [107]
Blood serum with or without lecithin [108]
n-Butylamine [109]
Caesium oleate [110]
Calcium carbonate, calcium arsenate, lead arsenate, zinc oxychloride, basic zinc chloride, Oxford clay, ferrous hydrosulfide or glycerin [111]
Calcium ceryl sulfonate [112]
Calcium chloride and borax [113]
Calcium ricinoleate [114]
Calcium,triricolein phosphite [115]
Carasol (sulfonated oil)[116]
Carbitol citrate [117]
Carbon black [118]

Carbosterol (carbitol stearate)[119]

Carob bean extract and alkali[120]

Casein[121]

Casein, alkaline, with soap[122]

Cellulose, alkylated[123]

Ceryl potassium sulfate[124]

Cetyl acid sulfate[125]

Cetyl alcohol with sodium lauryl sulfate[126]

Cetyl dimethylaminoacetate hydrobromide[127]

Cetyl or stearyl alcohols[128]

Cetyl or stearyl alcohol with resin alcohol and water[129]

Chlorinated fatty acids with strong alkalies[130]

Chlorinated oil-soluble petroleum sulfonate soap[131]

Cholestenone sulfonate salts[132]

Cholesterol[133]

Cholesterol betaine hydrochloride[134]

Cholesterol, isocholesterol, metacholesterol, oxycholesterol, lanolin alcohol, ceryl alcohol, carnaubyl alcohol, cetyl alcohol and lanolin[135]

Cholesterol laurate[136]

Cholesterol or oxycholesterol and albumins[137]

Cholesterol stearate[138]

Clay, colloidal, with calcium silicate[139]

Coal, brown, or peat[140]

Colloresin (methyl cellulose)[141]

Condensation product of aminoguanidine with higher fatty acids[142]

Condensation product of 1-chloronaphthalene with formaldehyde[143]

Condensation product of α-diethylamino-β-hydroxypropylamine with oleic or stearic acid; α-diethylamino-β-hydroxy-α-phenylaminopropane with oleic or stearic acid chloride[144]

Condensation product of fatty acid halides and albumin decomposition products[145]

Condensation product of oleic acid and ethylene oxide[146]

Condensation product of secondary or tertiary hydroxyalkylamines and aromatic acids, e.g., triethanolamine benzoate[147]

Condensation products of starch, dextrin or cellulose with stearic, palmitic, oleic or linoleic acid[148]

Condensation product of sulfated mineral oil fraction with monohydric saturated alcohol[149]

Copper resinate[150]

Cresol linoleic or phenololeic acids[151]

Cyclic urethans[152]

Cyclono (methyl cyclohexanone glyceryl acetal)[153]

Cyclopon A and GA (fatty acid amide alkylsulfonate)[154]

Deceresol A Y (sodium salt of diamylsulfosuccinate, U. S. Patent 2,028,091)[155]

Deceresol M A (sodium salt of dimethylamylsulfosuccinate, U. S. Patent 2,028,091)[156]

Deceresol O S (sodium salt of diisopropylnaphthalenesulfonic acid)[157]

Deceresol OT (sodium salt of dioctylsulfosuccinate, U. S. Patent 2,028,091)[158]

Dicholesteryl phosphate[159]

Diethanolamine naphthenate[160]

Diethylaminoethanol[161, 162]

Diethylene glycol glyceryl monooleate[163]

Diethylene glycol glyceryl monoricinoleate[164]

Diethylene glycol monolaurate (diglycol laurate neutral)[165]

Diethylene glycol monooleate[166]

Digitonin[167]

Diglycol laurate S[168]

Diglycol oleate[169]

Dihydric alcohol completely esterified with a higher fatty acid and containing free fatty acid[170]

Dimethylcyclohexylamine oleate[171]

Distearin (glyceryl distearate)[172]

Dodecyl, cetyl or octadecyl pyridinium trialkylammonium halides[173]

Duponol G (long chain alcohol sulfonate)[174]

Duponol OS (oil-soluble alkyl sulfate)[175]

Duponol OS (oil-soluble alkyl sulfate)[176]

Duponol WS (oil-soluble alkyl sulfate)[177]

Egg yolk[178]

Egg yolk powder and alkaline casein[179]

Emulgor A[180]

Emulphor AG oil-soluble[181]

Emulphor or methyl cellulose[182]

Emulsifier L (phosphate compound with wetting agent)[183]

Emulsifier 157[184]

Esters of abietic acid[185]

Esters of montan wax[186]

Ethanolamine[187]

Ethanolamine sulfonates[188]

Ethylene glycol monolaurate[189]

Ethylene glycol monooleate[190]

Ethylene glycol monostearate and stearate soap[191]

Ethylene oxide, polymerized[192]

Ethylene polymer with triethanolamine potassium oleate[193]

Extract of oak bark[194]

Fastolac (mixture of vegetable gums)[195]

Fatty acids having better emulsifying properties than neutral fats or synthetic fatty acid esters[196]

Ferric oxide, colloidal[197]
Filtra blend (purified petroleum sulfonates)[198]
Fish roe[199]
Floex (condensation product of higher fatty acids)[200]
Fructose+, mannitol+ or sorbitol monostearate[201]
Fullers' earth[202]
Galactose[203]
Galactose and pectin[204]
Galagum C (refined vegetable carbohydrate)[205]
Gamboge[205a]
Gardinol LS (sodium oleyl sulfate)[206]
Gardinol W (sodium lauryl sulfate)[207]
Gelatin[208]
Gelatin, deaminized[209]
Gelatin and urea[210]
GKS-5, a mixture of complex aromatic sulfonic acids and aromatic acids with aliphatic side chains[211]
Glucose monostearate[212]
Glue with pyridinium octadecylbromide[213]
Glue and starch[214]
Glycerides, mono- or di-, of higher fatty acids[215]
Glycerolated starch[216]
Glycerol higher fatty acid esters polymerized, e.g., diglycerol stearate[217]
Glycerophosphoric acid salts[218]
Glyceryl monohydroxystearate[218a]
Glyceryl monolaurate[219]
Glyceryl monooleate[220]
Glyceryl monoricinoleate S[221]
Glyceryl monostearate and diethylaminoethyloleylamide[222]
Glyceryl monostearate with diethylaminoethyl oleyl phosphate[223]
Glyceryl monostearate and soap[224]
Glyceryl oleate[225]
Glyceryl oleyl triricinoleate[225a]
Glyceryl (hexa, nona) ricinoleate[225b]
Glyceryl tartrate[226]
Glycol dioleate, polymerized[227]
Glycol distearate, polymerized[228]
Glycol glyceryl stearate or glycol glyceryl laurate[229]
Glycol monolaurate, polymerized[230]
Glycol monooleate, glyceryl dihydroxystearate, triethylene glycol monostearate[231]
Glycol monostearate, polymerized[232]
Glycosterin (diglycol stearate, U. S. Patent 1,914,100)[233]
Gomagel (modified vegetable protein)[234]

Gum acacia[235]

Gum dammar[236]

Gum ghatti, sodium oleate, sodium glycocholate, albumin and lipose[237]

Gum tragacanth[238]

Herrin milt[239]

Higher fatty or chlorinated fatty acids with acid Turkey red oil or other sulfated oils[240]

Higher fatty acid ester of sugars or sugar alcohols[241]

Humic acid or insoluble humic acid salts[242]

Hydrohexalin (Hydralin) and soap[243]

Hydromalin (animated glyceride)[244]

Hyglin (water-soluble cellulose ether)[245]

Idrapid (octohydroanthracene mesasulfonic acids)[246]

Igepal CA, CTA and CE (polymerized ethylene oxide condensation product)[247]

Igepon A, Igepon T[248]

Igepon AP extra (oleic acid ester of aliphatic compound)[249]

Igepon T[250]

Intramine (sodium salt of sulfonated lauryl and myristyl collamide, U. S. Patent 1,981,792)[251]

Iodine (acts as an emulsifier for those water-immiscible liquids in which its solutions exhibit particles under the ultra-microscope)[252]

Irish moss[253]

Iron oleate[254]

Iron tannate[255]

Isopropyl valerate with gum arabic and tragacanth[256]

Ivorit[257]

Kelgin (sodium alginate)[258]

Kleebatt emulsifier[259]

Lamepon A (condensation product protein derivative and fatty acids)[260]

Lanette wax SX[261]

Lanette wax SX, Lanette wax SXN (mixture of fatty alcohols and emulsifying agent)[262]

Lanolin, solvent extract[263]

Lead oleate[264]

Lead salt of lauryl-1-sulfonate[265]

Lead sulfate[266]

Lecithin[267]

Lecithin and benzyl alcohol[268]

Lecithin and cholesterol[269]

Lecithin and diglycerides of higher fatty acids[270]

Lecithin hydrate[271]

Lecithin and lactic acid[272]

Lecithin, lysolecithin or lysocephalin[273]
Lecithin, oxidized[274]
Lecithin, oxidized soya bean[275]
Lecithin and methyl cellulose[276]
Lecithin and pine oil[277]
Lexinol (lecithin and associated phosphatides)[278]
Lignin derivatives[279]
Linseed aqueous extract[280]
Lithium oleate[281]
Lorol (lauryl alcohol)[282]
Lorol (technical dodecyl (lauryl) alcohol)[283]
Lupogum (locust bean gum)[284]
Magnesium chloride and cotton wadding[285]
Magnesium oleate[286]
Magnesium resinate[287]
Mannide dilaurate[288]
Mannide dipalmitate[289]
Mannide monolaurate[290]
Mannide monomyristate[291]
Mannide monooleate[292]
Mannide monopalmitate[293]
Mannide monoricinoleate[294]
Mannide monostearate[295]
Mannitan dilaurate[296]
Mannitan laurate, modified[297]
Mannitan monolaurate[298]
Mannitan monolaurate, modified[299]
Mannitan monomyristate[300]
Mannitan monomyristate, modified[301]
Mannitan monooleate[302]
Mannitan monopalmitate[303]
Mannitan monopalmitate, modified[304]
Mannitan monoricinoleate[305]
Mannitan monostearate[306]
Mannitan monostearate, modified[307]
Mannitan oleate[308]
Mannitan tetralaurate[309]
Mannitan trilaurate[310]
Mannitol glyceryl hydroxystearate[310a]
Mannitol glyceryl monolaurate[311]
Mannitol glyceryl monooleate[312]
Manucol V (sodium alginate)[313]
Maprofix powder, Maprofix paste (sodium borosulfate of technical cetyl to octadecenyl alcohol)[314]

Mapromol powder, Mapromol paste (sodium borosulfate of technical octadecenyl alcohol)[315]
Melissyl calcium phosphate [316]
Methocel (methyl cellulose)[317]
Methyl cellulose [318]
Methyl cellulose and cetyl alcohol [319]
Methyl cellulose and lecithin [320]
Miscibol [321]
Modinal D paste (long-chain alcohol sulfate)[322]
Modinal ES paste (sodium sulfate of technical octadecenyl alcohol)[323]
Modinal ES paste (sodium oleyl sulfate)[324]
Monoaryl ethers of polyhydric alcohols with hydrotropic compounds of carboxylic or sulfonic acids of aliphatic, aromatic and hydroaromatic series [325]
Monoethanolamine linoleate [326]
Mono- or di- fatty acid glyceride and monofatty acid ester of glycols [327]
Monostearin [328]
Monostearin sulfoacetate [329]
Monostearyl esters of diethylene glycol, glycerol or diglycerol [330]
Monostearyl glucose [331]
Monostearyl glycerol, monostearyl diethylene glycol, dipalmityl glycerol [332]
Monostearyl mannitol [333]
Morpholine oleate [334]
Morpholine tetradecyl sulfate [335]
Myristic esters of polyhydric alcohols [336]
Nacconol NR (sodium alkylaryl sulfonate)[337]
Naphthenic acids or acid naphthenic resin with caustic soda solution [338]
Nekal A (sodium octohydroanthracene mesasulfonate)[339]
Nekal A E M [340]
Nekal BX (sodium naphthalene sulfonate)[341]
Nekal S [342]
Nelgin (modified colloidal silicate)[343]
Neomerpin [344]
Neomerpin N [345]
Nonaethylene glycol abietate, laurate, oleate or stearate [345a]
Nopco 1216-K [346]
Noremulsol [347]
Ocenol (technical oleyl alcohol)[348]
Octadecylamine soaps, adipyl, glycolyl or levulinyl [348a]
Octylamine [349]

Oil, Ahco base (sulfonated compound)[350]

Oil, base S-763A (sulfonated mineral oil)[351]

Oil or fat, phosphated or acetyl phosphated[352]

Oil monopole (double sulfonated castor oil)[353]

Oil, oxidized coal tar oil[354]

Oil, oxidized or polymerized vegetable and polyhydric alcohols partially esterified with higher fatty acids[355]

Oil, oxidized soya bean[356]

Oil, sunflower, oxized[357]

Oil, Turkey red[358]

Oil, Turkey red, and diammonium hydrogenphosphate[359]

Oleo glyceryl sulfate (highly sulfated glyceryl fatty esters)[360]

Oleyl or sulfonated fatty alcohols[361]

Olibanum[361a]

Oxycholesterol[362]

Palmityl glycine[363]

Palmityl and stearyl alcohols[364]

Paremulsol[365]

Pectin and fructose, sucrose and mannose[366]

Pectin or hemicellulose[367]

Pectin, milk, and sugar[368]

Petronate (sodium sulfated naphthenates)[369]

Pharmagel (specially refined gelatin)[370]

Phosphated higher fatty alcohols[371]

Phosphoproteins[372]

Phosphoproteins, globulin, or albumin[373]

Phosphoric acid esters of higher molecular weight[374]

Phosphosol[375]

Phosphotex[376]

Phytosterols[377]

Piperidine or organic acids[378]

Pluratex (alkylaryl sulfonate)[379]

Polyglycerol fatty acid esters[380]

Polyglycerol fatty ethers, e.g., diglycerol monolaurate[381]

Polyhydric alcohol partially esterified with fatty acid amino products[382]

Polyhydric alcohol partially esterified with higher fatty acid and an alkali[383]

Polyhydric alcohol partially esterified with a higher fatty acid and containing free fatty acid[384]

Polyhydric alcohol partially esterified with a higher fatty acid and sodium salt of a sulfated higher fatty alcohol[385]

Polymerized glycol higher fatty acid ester, e.g., polyglycol stearate[386]

Polysulfonates of aromatic polyalkylene ethers[387]

Polyvinyl alcohol[388, 389]
Polyvinyl alcohol sulfate[390]
Potassium abietate[391]
Potassium cetyl sulfoacetate[392]
Potassium chaulmoograte[393]
Potassium naphthenate[394]
Potassium oleate[395]
Potassium palmolate[396]
Proflex[397]
Proflex or hydromalin[398]
Prolaurin (propylene glycollaurate)[399]
Propyl or butyl aromatic sulfonic acids[400]
Propylene glycol monolaurate[401]
Propylene glycol monooleate[402]
Propylene glycol monoricinoleate[403]
Propylene glycol monostearate[404]
Protegin[405]
Proteins, alkaline animal or fish[406]
Proteins (hydrolyzed with alkali)[407]
Protex gel (aliphatic laurylamide sulfonated alkylbenzimidazol)[408]
Quaternary ammonium derivative of amino alcohol compound[409]
Reaction product of an aminocarboxylic acid with an isocyclic carboxylic acid[410]
Reaction product of polyvinyl alcohol and an aldehyde[411]
Reaction product of a saponifiable wax or fat with a nitrogenous base[412]
Reaction product of shellac with a nitrogen containing base, e.g., ammonia or methylamine[413]
Reaction products of substituted thiocyanates and substituted amino acids[414]
Red lead[415]
Rosin or wax with polyglycerol monocarboxylic ester[416]
Rosoap A[417]
"Santomerse" (alkyl aryl sulfonate)[418]
Sapamine[419]
Sapamines KW, MS (salts of amides derived from higher fatty radicals)[420]
Sapogenin, betulin, ursolic, or oleanolic acid or their salts[421]
Saponin[422]
Saponin and alkali[423]
Saponin and borax or ammonium carbonate[424]
Saponin and methyl cellulose[425]
Serum[426]
Sherosope (sodium sulfonaphthenate)[427]
Silica, clay or iron oxide[428]

Soap, amine[429]
Soap, n-butyl amine[430]
Soap, castile[431]
Soap, n-dibutylamine[432]
Soap, 2-ethylhexylamine[433]
Soap, guanidine[434]
Soap, halogenated fatty acid[435]
Soap, hydroxyalkylamine (ethanolamine)[436]
Soap, metallic[437]
Soap, myristic acid[438]
Soap, naphthenic[439]
Soap and polyhydric alcohol partially esterified with higher fatty acid[440]
Soap, potassium triethanolamine[441]
Soap, sodium triethanolamine[442]
Sodium abietate[443]
Sodium alkyl naphthalene sulfonates[444]
Sodium cerotate[445]
Sodium cetyl phosphate[446]
Sodium cetyl sulfonate[447]
Sodium cholate[448, 449]
Sodium cholesteryl sulfoacetate[450]
Sodium cymene sulfonate[451]
Sodium elaidate[452]
Sodium fatty alcohol sulfonate and G-cetyl betaine[453]
Sodium glycocholate[454]
Sodium glycol monooleate sulfate[455]
Sodium heptadecyl sulfate[456]
Sodium isopropylnaphthalene sulfonate and bone glue[457]
Sodium lauryl sulfate[458]
Sodium metasilicate[459]
Sodium myristate or sodium palmitate[460]
Sodium naphthenate[461]
Sodium oleate[462]
Sodium oleate, sodium myristate, sodium ricinoleate, sodium stearate, sodium resinate[463]
Sodium petroleum sulfonate[464]
Sodium polyacrylate[465]
Sodium, potassium, ammonium or calcium gluconate[466]
Sodium ricinoleate[467]
Sodium salt of sulfonated stearic acid anilide[468]
Sodium silicate[469]
Sodium stearate[470]
Sodium tetradecyl sulfate[471]
Sorbide dilaurate[472]

Sorbide monolaurate[473]
Sorbide monomyristate[474]
Sorbide monooleate[475]
Sorbide monopalmitate[476]
Sorbide monoricinoleate[477]
Sorbide monostearate[478]
Sorbitan dilaurate[479]
Sorbitan monolaurate[480]
Sorbitan monomyristate[481]
Sorbitan monooleate[482]
Sorbitan monopalmitate[483]
Sorbitan monoricinoleate[484]
Sorbitan monostearate[485]
Sorbitan sulfonated ricinoleate[486]
Sorbitan tetralaurate[487]
Sorbitan tetrastearate[488]
Sorbitan trilaurate[489]
Sorbitol dilaurate[490]
Sorbitol dioleate[491]
Sorbitol distearate[492]
Sorbitol glyceryl monolaurate[493]
Sorbitol glyceryl monolaurate S284[494]
Sorbitol glyceryl monolaurate S285[495]
Sorbitol glyceryl monooleate S282[496]
Sorbitol glyceryl monooleate S283[497]
Sorbitol glyceryl monostearate[498]
Sorbitol laurate[499]
Sorbitol oleate[500]
Sorbitol stearate A[501]
Soya bean meal and caustic potash[502]
Soya bean phosphatides[503]
Soybean protein[504]
Starch, dextrin, casein, Irish moss, sodium silicate or latex[505]
Stearyl or cetyl alcohol and mixture of sodium salts of their sulfonates[506]
Stearyl glutamic acid[507]
Stearyl sucrose[508]
Stenol (mixture of stearyl and cetyl alcohols)[509]
Sterols[510]
Strontium oleate[511]
Sucrose[512]
Sucrose, glucose or mannitol partially esterified with fatty acids[513]
Sucrose oleate[514]
Sugar house scum[515]
Sulfanole C. P. (alcohol fatty derivative)[516]

Sulfanole P. B. (aliphatic fatty derivative)[517]
Sulfated fatty alcohol[518]
Sulfated monoglycerides[519]
Sulfated oleyl acetate[520]
Sulfite[521]
Sulfite cellulose lye[522]
Sulfite liquor[523]
Sulfite liquor, aliphatic or aromatic sulfonic acids[524]
Sulfo dicarboxylic acids, e.g., octyl disulfosuccinic, etc.[525]
Sulfo fatty aromatic acids[526]
Sulfonates, alkali, high molecular, e.g., sodium tetrahydronaphthalene-β-sulfonate[527]
Sulfonate, petroleum[528]
Sulfonated cocoa butter or stearin[529]
Sulfonated distillation product of glycol and olive oil[530]
Sulfonated fatty acids[531]
Sulfonated fatty hydroxy acid esters[532]
Sulfonated higher fatty acids[533]
Sulfonated hydrogenated castor oil[534]
Sulfonated hydrogenated castor oil, ammonium salt[535]
Sulfonated hydrogenated castor oil, isopropylamine[536]
Sulfonated hydrogenated castor oil, potassium salt[537]
Sulfonated hydrogenated castor oil, sodium salt[538]
Sulfonated hydrogenated castor oil, triethanolamine[539]
Sulfonated oil, castor[540]
Sulfonated oil, coconut[541]
Sulfonated oil, fish, egg, apricot, peach-kernel, almond or teaseed[542]
Sulfonated oil, mineral and benzol[543]
Sulfonated oil, mineral, condensed with alcohols[544]
Sulfonated oils, oxidized, e.g., oxysulfoleic acid[545]
Sulfonated oil, palm[546]
Sulfonated oil, red[547]
Sulfonated oil, Turkey red[548]
Sulfonated oleylbutyrate or other sulfonated higher fatty alcohol esters[549]
Sulfonated polymerized oils, fats or fatty acids[550]
Sulfonated propylene glycol ricinoleate[551]
Sulfonated spermaceti, beeswax or wool-fat[552]
Sulfonated squalene[553]
Sulfonated stearic or palmitic acids[554]
Sulfonated stearin pitch[555]
Sulfonated stearin pitch[556]
Sulfonated tallow[557]

Sulfonated wool-fat fatty acids[558]

Sulfonic acid, aromatic, with at least one alkyl group and a light metal salt[559]

Sulfonic acid, substituted aromatic, e.g., amyl naphthalene-β-sulfonic acid[560]

Sulfonic acid, unsaturated[561]

Sulfuric esters of amides or anilides[562]

Sulfuric ester of higher fatty alcohol[563]

Tegacid[564]

Tegin (glyceryl monostearate)[565]

Tegin P (propylene glycol monostearate)[566]

"Tergitol" penetrant (sodium sulfate of higher alcohol)[567]

Tetraethylene glycol stearate[567a]

Tetrahydronaphthalene sulfonic salts[568]

Tetrasodium pyrophosphate (anhydrous powder and flakes)[569]

Thoreps[570]

Triethanolamine[571]

Triethanolamine and other alkylolamines[572]

Triethanolamine condensed with stearic sulfonic or sulfonated carboxylic acids[573]

Triethanolamine naphthenate[574]

Triethanolamine (mono, di or tri) laurates[574a]

Triethanolamine stearate[575]

Triethanolamine tetradecyl sulfate[576]

Trigamine[577]

Trigamine stearate[578]

Triglyceride, partially saponified, containing soap, e.g., glyceryl mono- and distearate[579]

Trihydroxyethylamine stearate[580]

Trihydroxyethylamine stearate, special[581]

Trimethylamine[582]

Trimethylol aminomethane[583]

Triton NE (high molecular weight complex alcohol)[584]

Triton W-30 (sulfated aromatic ether alcohol)[585]

Triton K-60 (cation-active quaternary salt)[586]

Triton 720 (sulfonated ether)[587]

Triton E-79 (amine salt of a sulfated ether)[588]

Turkelene[589]

Turpentine, spruce[590]

Tylose (methyl cellulose)[591]

Urethane oleate[592]

Urethane oleate (cyclic)[593]

Ursolic acid[594]

Vaneps[595]

Warcosol (akyl naphthalene sulfonate)[596]

Wax, saponifiable, e.g., montan, I. G., carnauba, Rilan; with borax or ammonium bicarbonate[597]

Whey protein[598]

Wool fat and phenol, sulfonated[599]

Xerol (glyceryl monostearate)[600]

Xynomine powder, Xtnomine paste (sulfated boroamide ester of aliphatic compounds containing 12 to 18 carbon atoms, U. S. Patent 1,918,373)[601]

REFERENCES *

[1] Milne, Pharm. J. *146,* 76 (1941).
[2] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[3] Stratton, Pharm. J. *129,* 286 (1932).
[4] Preiser, Ger. 646,503 (1937).
[5] Catalog, National Oil Products Co., Inc., Harrison, N. J.
[6] Catalog, Ciba Co., N. Y. C.
[7] Schlinck, Swed. 42,275 (1917).
[8] Catalog, Th. Muhlethaler Co., Nyon, Switzerland.
[9] Ger. 509,153 (1926).
[10] Catalog, Algin Corporation of America, N. Y. C.
[11] Kolesov, J. Rubber Ind. (U.S.S.R.) *9,* 291 (1933).
[12] Baddiley, Brit. 274,611 (1926).
[12a] Hunsdieker, Brit. 422,461 (1935).
[13] Bertsch, U. S. 2,027,896 (1936).
[14] Rumpf, Compt. rend. *212,* 83 (1941).
[15] I. G., Fr. 706,105 (1930); Kollek, U. S. 1,930,853 (1933).
[16] Katzman, U. S. 2,248,089 (1941).
[17] Catalog, Alrose Chemical Co., Providence, R. I.
[18] Lewis, U. S. 1,783,366 (1930).
[19] Dickeson, Fr. 838,699 (1939); Brit. 487,855 (1938).
[20] Redlich, Ger. 502,237 (1927).
[21] Pyhala, Ole, Fette, Wachse *4,* 9 (1937).
[22] Drug & Cosmetic Industry *49,* 95 (1941).
[23] Briggs, J. Phys. Chem. *18,* 34 (1912).
[24] Horst, U. S. 2,213,984 (1940).
[25] Katz, U. S. 2,216,618.
[26] Catalog, National Oil Products Co., Harrison, N. J.
[27] Catalog, National Oil Products Co., Harrison, N. J.
[28] Catalog, National Oil Products Co., Harrison, N. J.
[29] Catalog, National Oil Products Co., Harrison, N. J.
[30] Catalog, Arabol Mfg. Co., N. Y. C.
[31] Haggenmacher, U. S. 2,206,090 (1940).
[32] Haggenmacher, U. S. 2,206,090 (1940).

---

* U. S. refers to U. S. Patent; Ger. refers to German Patent; Fr. refers to French Patent; Brit. refers to British Patent; Can. refers to Canadian Patent; Dutch refers to Dutch Patent; Swed. refers to Swedish Patent.

[33] Katz, U. S. 2,216,618.
[34] I. G., Ger. 543,788.
[35] Haggenmacher, U. S. 2,206,090 (1940).
[36] Haggenmacher, U. S. 2,206,090 (1940).
[37] Catalog, National Oil Products Company, Harrison, N. J.
[38] Catalog, National Oil Products Company, Harrison, N. J.
[39] Catalog, Sharples Solvents Corporation, Philadelphia, Pa.
[40] Synthetic Organic Chemicals (Carbide & Carbon Chem. Corp., N. Y. C.) p. 55 (1940).
[41] Synthetic Organic Chemicals (Carbide & Carbon Chem. Corp., N. Y. C.) p. 55 (1940).
[42] Synthetic Organic Chemicals (Carbide & Carbon Chem. Corp., N. Y. C.) p. 55 (1940).
[43] Synthetic Organic Chemicals (Carbide & Carbon Chem. Corp., N. Y. C.) p. 55 (1940).
[44] Catalog, Sharples Solvents Corp., Philadelphia, Pa.
[45] Catalog, Sharples Solvents Corp., Philadelphia, Pa.
[46] Catalog, National Oil Products Company, Harrison, N. J.
[47] Catalog, Sharples Solvents Corporation, Philadelphia, Pa.
[48] Synthetic Organic Chemicals (Carbide & Carbon Chem. Corp., N. Y. C.) 1940.
[49] Synthetic Organic Chemicals (Carbide & Carbon Chem. Corp., N. Y. C.) 1940.
[50] Synthetic Organic Chemicals (Carbide & Carbon Chem. Corp., N. Y. C.) 1940.
[51] Dreyfus, Brit. 394,657 (1933).
[52] Catalog, Victor Chem. Works, Chicago, Ill.
[53] Catalog, Commercial Solvents Corp., Terre Haute, Ind.
[54] Catalog, Commercial Solvents Corp., Terre Haute, Ind.
[55] Catalog, Commercial Solvents Corp., Terre Haute, Ind.
[56] Catalog, Commercial Solvents Corp., Terre Haute, Ind.
[57] Catalog, Commercial Solvents Corp., Terre Haute, Ind.
[58] Catalog, Commercial Solvents Corp., Terre Haute, Ind.
[59] Hodgins, U. S. 2,215,038 (1940).
[60] Vanderbilt, U. S. 2,247,106 (1941).
[61] Catalog, Commercial Solvents Corp., Terre Haute, Ind.
[62] Catalog, Commercial Solvents Corp., Terre Haute, Ind.
[63] Catalog, Commercial Solvents Corp., Terre Haute, Ind.
[64] Catalog, Commercial Solvents Corp., Terre Haute, Ind.
[65] Catalog, Commercial Solvents Corp., Terre Haute, Ind.
[66] Catalog, Commercial Solvents Corp., Terre Haute, Ind.
[67] Catalog, Commercial Solvents Corp., Terre Haute, Ind.
[68] Catalog, Commercial Solvents Corp., Terre Haute, Ind.
[69] Reddish, U. S. 1,780,144.
[70] Catalog, Commercial Solvents Corp., Terre Haute, Ind.
[71] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[72] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[73] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[74] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[75] Kadmer, Seifen.-Z. *66*, 171 (1939).

[76] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[77] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[78] Beagle, U. S. 2,216,180 (1940).
[79] Berkenheim, Org. Chem. Ind. (U.S.S.R.) *7,* 437 (1940).
[80] Thackston, U. S. 2,196,367 (1940).
[81] Kheifets, Kozh. Obux. Prom. (U.S.S.R.) *14,* 794 (1935).
[82] Birkenheim, Prom. Org. Chem. I, 437 (1940).
[83] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[84] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[85] Saint-Champ, Fr. 721,400 (1930).
[86] Scurti, Staz. Sper. Agrar. Iral. *52,* 436 (1920).
[87] I. G., Brit. 273,757 (1926).
[88] Williams, J. Soc. Dyers & Colorists *43,* 296 (1925).
[89] Rochow, J. Ind. & Eng. Chem. *28,* 1297 (1936).
[90] Catalog, Jungmann and Co., N. Y. C.
[91] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[92] Pfaff, Reichstoff Ind. *9,* 2 (1934).
[93] Catalog, American Cyanamid & Chem. Corp., N. Y. C.
[94] Catalog, Colgate-Palmolive-Peet, Jersey City, N. J.
[95] Catalog, Colgate-Palmolive-Peet, Jersey City, N. J.
[96] Catalog, Monsanto Chemical Co., Everett Station, Boston, Mass.
[97] Catalog, Monsanto Chemical Co., Everett Station, Boston, Mass.
[98] Catalog, Monsanto Chemical Co., Everett Station, Boston, Mass.
[99] Catalog, The Arkansas Company, Inc., Newark, N. J.
[100] Dow, Bur. Mines, Repts. Invest. *2692* (1925).
[101] Lottermoser, Kolloid Z. *48,* 362 (1929).
[102] Clowes, J. Phys. Chem. *20,* 407 (1916).
[103] Catalog, Standard Oil Co. of N. J., N. Y. C.
[104] Catalog, Alframine Corp., N. Y. C.
[105] Ermolenko, Kolloidny Zhur. *4,* 85 (1938).
[106] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[107] Billinghame, U. S. 1,549,436 (1925).
[108] Moskovits, Dutch 2,269 (1918).
[109] Catalog, Carbide & Carbon Chem. Corp., N. Y. C.
[110] Harkins, Fifth Colloid Sympos. Monograph, p. 19 (1928).
[111] Bailey, U. S. 1,231,554 (1917).
[112] Emulsol, Fr. 705,000 (1930).
[113] Price, Can. 275,513 (1927).
[114] Bogolyubov, Russ. 53,744 (1938).
[115] Emulsol, Fr. 705,000 (1930).
[116] Catalog, Carolina Aniline & Ext. Co., Inc., Charlotte, N. C.
[117] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[118] Schlaepfer, J. Chem. Soc. *113,* 522 (1918).
[119] Catalog, Van Dyk Co., Jersey City, N. J.
[120] Schwazkopf, Ger. 564,046 (1930).
[121] Troger, Farbe V. Lack 472,487,499 (1933).
[122] Baumheier, Ger. 584,949 (1933).
[123] I. G., Fr. 33,278 (1927).
[124] Emulsol, Fr. 705,000 (1930).
[125] Emulsol, Fr. 705,000 (1930).

[126] Gibson, J. Am. Pharm. Assoc. *30,* 196 (1941).
[127] Emulsol, Fr. 705,000 (1930).
[128] Sedgwick, Soap, Perf. Cosmetics *12,* 161 (1939).
[129] U. S. 2,164,723 (1940).
[130] Brit. 340,011 (1929).
[131] Adams, U. S. 2,243,994 (1941).
[132] Windaus, Can. 392,387 (1940).
[133] Rochow, J. Ind. & Eng. Chem. *28,* 1297 (1936); Winter, Soap, Perfumery and Cosmetics, p. 126 (1937).
[134] Emulsol, Fr. 705,000 (1930).
[135] Augustin, Am. Perfumer *28,* 348 (1933).
[136] Amer. Perfumer *41,* 52 (1940).
[137] Schlinck, Brit. 104,933 (1916).
[138] Amer. Perfumer *41,* 52 (1940).
[139] Gross, U. S. 1,788,964 (1931).
[140] Kraft, Ger. 591,340 (1934).
[141] Catalog, General Drug Co., N. Y. C.
[142] I. G., Fr. 845,137 (1940).
[143] Beer, Brit. 362,016 (1930).
[144] I. G., Brit. 346,387 (1929).
[145] Grunau, Ger. 692,070 (1940).
[146] I. G., Brit. 439,524 (1935).
[147] Kritchevsky, U. S. 2,260,384 (1941).
[148] Schou, Fr. 825,701 (1938).
[149] Braddiley, U. S. 1,836,431 (1931).
[150] Briggs, J. Phys. Chem. *18,* 34 (1912).
[151] Kaufmann, U. S. 2,154,850 (1939).
[152] Hodgins, U. S. 2,215,038 (1940).
[153] Catalog, E. I. du Pont de Nemours & Co., Wilmington, Del.
[154] Catalog, General Dyestuff Corp., N. Y. C.
[155] Catalog, American Cyanamid & Chemical Corp., N. Y. C.
[156] Catalog, American Cyanamid & Chemical Corp., N. Y. C.
[157] Catalog, American Cyanamid & Chemical Corp., N. Y. C.
[158] Catalog, American Cyanamid & Chemical Corp., N. Y. C.
[159] Emulsol, Fr. 705,000 (1930).
[160] Zimmer, U. S. 2,230,556 (1941).
[161] Catalog, Carbide and Carbon Chem. Co., N. Y. C.
[162] Synthetic Organic Chemicals (Carbide & Carbon Chem. Corp., N. Y. C.).
[163] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[164] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[165] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[166] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[167] Emulsol, Fr. 705,000 (1930).
[168] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[169] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[170] Bennett, U. S. 1,914,100 (1933).
[171] Bale, Brit. 469,642 (1937).
[172] Kawai, Soc. Chem. Ind. (Jap.) *43,* 170 B (1930).
[173] Hailwood, Brit. 393,276 (1933).

[174] Catalog, E. I. du Pont de Nemours & Co., Wilmington, Del.
[175] Catalog, E. I. du Pont de Nemours & Co., Wilmington, Del.
[176] Catalog, E. I. du Pont de Nemours & Co., Wilmington, Del.
[177] Catalog, E. I. du Pont de Nemours & Co., Wilmington, Del.
[178] Henley's Twentieth Century Formulas, p. 290 (1940).
[179] Kozin, Maslo, Zhir. Deloe *3,* 28 (1937).
[180] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[181] Catalog, General Dyestuff Corp., N. Y. C.
[182] Kadmer, Seifen.-Z. *66,* 171 (1939).
[183] Catalog, E. I. du Pont de Nemours & Co., Wilmington, Del.
[184] Pfaff, Reichstoff Ind. *9,* 2 (1934).
[185] Ellis, Chemistry of Synthetic Resins, p. 829 (1935).
[186] Ellis, Chemistry of Synthetic Resins, p. 829 (1935).
[187] Trusler, Oil and Fat Ind. *5,* 338 (1928); Cerisy, Tiba *16,* 183 (1938).
[188] I. G., Brit. 309,842 (1927).
[189] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[190] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[191] Schrader, U. S. 1,826,900 (1931).
[192] I. G., Brit. 353,926 (1930).
[193] Alvarado, U. S. 2,290,794 (1942).
[194] Ewer, U. S. 1,527,509 (1925).
[195] Catalog, J. L. Hopkins Co., N. Y. C.
[196] Meunier, Collegium *84,* 277 (1910).
[197] Van der Minne, Chem. Weekblad *35,* 125 (1928).
[198] Catalog, Petroleum Specialties, Inc., N. Y. C.
[199] Ehrenreich, Brit. 284,707 (1927).
[200] Catalog, Ross and Rowe, Inc., N. Y. C.
[201] Harris, U. S. 2,114,490 (1938).
[202] Simens, U. S. 2,216,180 (1940).
[203] Seifriz, J. Phys. Chem. *29,* 738 (1925).
[204] Ivanov, Sovet. Farm. *5,* 27 (1934).
[205] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[205a] Goodwin, U. S. 1,774,092 (1930).
[206] Catalog, The Gardinol Corp., Wilmington, Del.; Catalog, E. I. du Pont de Nemours & Co., Wilmington, Del.
[207] Catalog, The Gardinol Corp., Wilmington, Del.
[208] Serralach, J. Ind. & Eng. Chem. *25,* 817 (1933); Bresler, Physik-Z. Sowjetunion *4,* 889 (1933); Tice, Drug & Cosmetic Ind. *38,* 635 (1936); Kuhl, Pharm.-Z. *81,* 694 (1936).
[209] Holmes, J. Phys. Chem. *32,* 763 (1928).
[210] P. C.
[211] Hauser, Mem. Inst. Org. Chem. and Tech., Acad. Sci. Ukrain U.S.S.R., 12, 90 (1941)
[212] Schmaltz, Kolloid-Z. *71,* 234 (1935).
[213] Todd, U. S. 1,981,292 (1934).
[214] Rohm, Ger. 518,920 (1929).
[215] Braunlich, Brit. 285,880 (1927).
[216] Zakarias, Parfumerie Moderne *20,* 114 (1927).
[217] Schou, Brit. 496,166 (1938).
[218] Rohm, Ger. 560,054 (1928).

[218a] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[219] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[220] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[221] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[222] Goldschmidt, Ger. 545,763 (1929).

[223] Goldschmidt, Fr. 690,330 (1930).

[224] Goldschmidt, Ger. 551,403 (1927).

[225] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[225a] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[225b] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[226] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[227] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[228] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[229] Rosendahl, Drug Cosmetic Ind. *41,* 497 (1937).

[230] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[231] Goldschmidt, Brit. 329,266 (1928).

[232] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[233] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[234] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[235] Rochow, Ind. & Eng. Chem. *28,* 1297 (1936).

[236] Holmes, J. Amer. Chem. Soc. *44,* 66 (1922); J. Phys. Chem. *29,* 1205 (1925).

[237] Koch, Oil & Soap, *18,* 86 (1941).

[238] Serralach, Ind. & Eng. Chem. *25,* 817 (1933).

[239] Emmerich, Ger. 688,647 (1940).

[240] Bohme, Brit. 512,927 (1939).

[241] Harris, U. S. 2,114,490 (1938).

[242] I. G., Brit. 430,917 (1935).

[243] Arndt, Kunststoffe *17,* 4 (1927).

[244] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[245] Catalog, Sylvania Industrial Corporation, N. Y. C.

[246] Noll, Seifen.-Z. *54,* 769 (1927).

[247] Catalog, General Dyestuff Corp., N. Y. C.

[248] Lederer, Angew. Chem. *47,* 119 (1934).

[249] Catalog, General Dyestuff Corp., N. Y. C.

[250] Catalog, General Dyestuff Corp., N. Y. C.

[251] Catalog, Synthetic Chemicals, Jersey City, N. J.

[252] Holmes, J. Amer. Chem. Soc. *47,* 323 (1925).

[253] Serralach, Ind. & Eng. Chem. *25,* 817 (1933).

[254] Clowes, J. Phys. Chem. *20,* 407 (1916).

[255] Hixon, U. S. 2,002,505 (1935); Lewis, U. S. 1,783,366 (1930).

[256] Frommer, Ger. 626,880 (1936).

[257] Pfaff, Riechstoff Ind. *9,* 2 (1934).

[258] Catalog, Kelco Co., N. Y. C.

[259] Pfaff, Riechstoff Ind. *9,* 2 (1934).

[260] Catalog, Chemical Marketing Co., N. Y. C.

[261] Pfaff, Riechstoff Ind. *9,* 2 (1934).

[262] Catalog, E. I. du Pont de Nemours & Co., Wilmington, Del.

[263] Barnes, U. S. 1,830,502 (1931).

[264] Briggs, J. Phys. Chem. *18,* 34 (1912).

[265] Lenher, U. S. 2,012,611 (1935).

[266] Sheppard, J. Phys. Chem. *23*, 634 (1919).

[267] Winter, Soap, Perfumery and Cosmetics, p. 126 (1937).

[268] Rewald, U. S. 1,934,005 (1933); H.M.A.-G., Ger. 561,200 (1930).

[269] Schwarz, Seifen.-Z. *63*, 170 (1936); A. G. Produkte, Ger. 266,175 (1926).

[270] Epstein, U. S. 2,062,782 (1936).

[271] Lund, U. S. 2,090,537 (1937).

[272] Rewald, Brit. 464,100 (1937).

[273] I. G., Brit. 505,983 (1939).

[274] Hans Muehlen, Brit. 372,232 (1932).

[275] Rollman, Brit. 356,384 (1929).

[276] Lehmann, Brit. 518,641 (1940).

[277] Asser, Ger. 615,481 (1935).

[278] Catalog, Amer. Lecithin Co., Elmhurst, N. Y.

[279] Cross, Ger. 516,566 (1926).

[280] Blichfeldt, Brit. 104,899 (1916).

[281] Clowes, J. Phys. Chem. *20*, 407 (1916).

[282] Catalog, E. I. du Pont de Nemours & Co.

[283] Catalog, E. I. du Pont de Nemours & Co., Wilmington, Del.

[284] Catalog, Jacques Wolf and Co., Passaic, N. J.

[285] Svensson, Brit. 461,913 (1937).

[286] Briggs, J. Phys. Chem. *18*, 34 (1912); Clowes, J. Phys. Chem. *20*, 407 (1916); Harkins, Fifth Colloid Sympos. Monograph, p. 19 (1928).

[287] Briggs, J. Phys. Chem. *18*, 34 (1912).

[288] Catalog, Atlas Powder Co., Wilmington, Del.

[289] Catalog, Atlas Powder Co., Wilmington, Del.

[290] Catalog, Atlas Powder Co., Wilmington, Del.

[291] Catalog, Atlas Powder Co., Wilmington, Del.

[292] Catalog, Atlas Powder Co., Wilmington, Del.

[293] Catalog, Atlas Powder Co., Wilmington, Del.

[294] Catalog, Atlas Powder Co., Wilmington, Del.

[295] Catalog, Atlas Powder Co., Wilmington, Del.

[296] Catalog, Atlas Powder Co., Wilmington, Del.

[297] Catalog, Atlas Powder Co., Wilmington, Del.

[298] Catalog, Atlas Powder Co., Wilmington, Del.

[299] Catalog, Atlas Powder Co., Wilmington, Del.

[300] Catalog, Atlas Powder Co., Wilmington, Del.

[301] Catalog, Atlas Powder Co., Wilmington, Del.

[302] Catalog, Atlas Powder Co., Wilmington, Del.

[303] Catalog, Atlas Powder Co., Wilmington, Del.

[304] Catalog, Atlas Powder Co., Wilmington, Del.

[305] Catalog, Atlas Powder Co., Wilmington, Del.

[306] Catalog, Atlas Powder Co., Wilmington, Del.

[307] Catalog, Atlas Powder Co., Wilmington, Del.

[308] Catalog, Atlas Powder Co., Wilmington, Del.

[309] Catalog, Atlas Powder Co., Wilmington, Del.

[310] Catalog, Atlas Powder Co., Wilmington, Del.

[310a] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[311] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[312] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[313] Milne, Pharm. J. *146,* 76 (1941).
[314] Catalog, Onyx Oil & Chemical Co., Jersey City, N. J.
[315] Catalog, Onyx Oil & Chemical Co., Jersey City, N. J.
[316] Emulsol, Fr. 705,000 (1930).
[317] Dow Chemical Company, Midland, Michigan.
[318] Deut. Apoth.-Z. *55,* 524 (1940).
[319] Deut. Hydrier, Ger. 573,291 (1930).
[320] Brit. 518,641.
[321] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[322] E. I. du Pont de Nemours & Co., Wilmington, Del.
[323] Catalog, Procter & Gamble Co., Ivorydale, Ohio.
[324] Catalog, E. I. du Pont de Nemours & Co., Wilmington, Del.
[325] Rheiner, U. S. 1,903,879 (1933).
[326] Bennett, U. S. 1,807,563 (1931).
[327] Newton, U. S. 2,232,401 (1941).
[328] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[329] Reynolds, U. S. 1,917,273 (1933).
[330] Harris, U. S. 2,109,842 (1938).
[331] Emulsol, Fr. 705,000 (1930).
[332] Emulsol, Fr. 711,299 (1931).
[333] Emulsol, Fr. 705,000 (1930).
[334] Carbide & Carbon Corp., Fr. 827,911 (1938); Robertson, Soap *14,* 99 (1938); Strother, U. S. 2,238,956 (1941).
[335] Carbide & Carbon Corp., Fr. 827,911 (1938); Robertson, Soap *14,* 99 (1938); Strother, U. S. 2,238,956 (1941).
[336] Catalog, Woburn Degreasing Co., Woburn, N. J.
[337] Catalog, National Aniline & Chemical Co., N. Y. C.
[338] Tanaka, J. Chem. Ind. (Jap.) *26,* 1190 (1928).
[339] Noll, Seifen.-Z. *54,* 769 (1927).
[340] Noll, Seifen.-Z. *54,* 843 (1927).
[341] Noll, Seifen.-Z. *54,* 843 (1927).
[342] Noll, Seifen.-Z. *54,* 769 (1927).
[343] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[344] Noll, Seifen.-Z. *54,* 843.
[345] Noll, Seifen.-Z. *54,* 843.
[345a] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[346] Catalog, National Oil Products Co., Inc., Harrison, N. J.
[347] Pfaff, Riechstoff Ind. *9,* 2 (1934).
[348] Catalog, E. I. du Pont de Nemours & Co., Wilmington, Del.
[348a] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[349] Synthetic Organic Chemicals (Carbide and Carbon Chem. Corp., N. Y. C.) p. 55 (1940).
[350] Catalog, Arnold, Hoffman Co., Providence, R. I.
[351] Catalog, Jacques Wolf & Co., Passaic, N. J.
[352] Bohme, Fr. 642,292 (1927).
[353] Same as 351.
[354] Bock, Ger. 518,394 (1926).
[355] Harlow, Brit. 530,240 (1939).
[356] Schov, U. S. 1,570,529 (1926).

[357] Bennett, Chemical Formulary, Vol. 3, p. 114 (1936).
[358] Minich, Textile Colorist, p. 698 (1939).
[359] Hotta, Japan 129,439 (1939).
[360] Catalog, Onyx Oil & Chemical Co., Jersey City, N. J.
[361] Yates, U. S. 2,091,062 (1937).
[361a] Goodwin, U. S. 1,774,092 (1930).
[362] Painter, U. S. 2,013,524 (1935).
[363] Emulsol, Fr. 705,000 (1930).
[364] Jorek, Pharm.-Z. *78*, 667 (1933).
[365] Pfaff, Riechstoff Ind. *9*, 2 (1934).
[366] Deiglmayer, Ger. 575,922, 585,586 (1934).
[367] Kereskedelmi, Hung, 110,097 (1934).
[368] Same as 366.
[369] L. Sonneborn Sons, Inc., N. Y. C.
[370] Catalog, Carbide and Carbon Chem. Co., N. Y. C.
[371] Redgrove, Am. Perfumer *38*, 35 (1939).
[372] Borthen, Fr. 693,242 (1930).
[373] Borthen, Brit. 358,444 (1929).
[374] Harris, U. S. 1,917,259 (1933).
[375] Catalog, Merrimac Division, Monsanto Chem. Co., Everett Station, Boston, Mass.
[376] Catalog, Merrimac Division, Monsanto Chem. Co., Everett Station, Boston, Mass.
[377] Sandquist, Brit. 329,305 (1929).
[378] Fr. 694,250 (1930).
[379] Catalog, Kearny Manufacturing Co., Inc., Kearny, N. J.
[380] Harris, U. S. 2,022,766 (1935).
[381] Harris, U. S. 2,258,820 (1941).
[382] Schrader, U. S. 2,121,305 (1938).
[383] Harris, U. S. 2,109,842 (1938).
[384] Bennett, U. S. 2,095,955 (1937).
[385] Schrauth, U. S. 2,086,479.
[386] Goldsmith, U. S. 2,269,529 (1941).
[387] R. and H., Brit. 506,667.
[388] I. G., Fr. 849,151 (1939).
[389] Dangelmajer, U. S. 2,237,753 (1941).
[390] I. G., Brit. 513,076 (1939).
[391] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[392] Emulsol, 705,000 (1930).
[393] Harkins, Fifth Colloid Sympos. Monograph p. 19 (1928).
[394] Vallance, Mfg. Chem. *12*, 53 (1941).
[395] Harkins, Fifth Colloid Sympos. Monograph p. 19 (1928).
[396] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[397] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[398] Bennett, Paint and Varnish Prod. Mgr. *9*, 28 (1933).
[399] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[400] Gunther, U. S. 1,755,179 (1930).
[401] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[402] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.
[403] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[404] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[405] Pfaff, Riechstoff Ind. *9*, 2 (1934).

[406] Jones, Brit. 264,955 (1925).

[407] Billinghame, Brit. 222,602 (1923).

[408] Catalog, Ciba Co., N. Y. C.

[409] Epstein, U. S. 2,213,979 (1940).

[410] Balle, U. S. 2,215,367 (1940).

[411] I. G., Fr. 699,676 (1930).

[412] Orthner, U. S. 2,098,551 (1937).

[413] Newton, U. S. 2,030,222 (1936).

[414] Muller, U. S. 2,214,971 (1940).

[415] Hofmann, Z. Physik. Chem. *33*, 385 (1913).

[416] Schnitzler, Ger. 584,490 (1933).

[417] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[418] Catalog, Monsanto Chemical Co., Boston, Mass.

[419] Pfister, Anales quim. farm. (Chile) 14 (1938).

[420] Catalog, Ciba Co., Inc., N. Y. C.

[421] Sando, U. S. 2,076,794.

[422] Brandup, Pharm. Zentralhalle *75*, 129 (1934); Serralach, Ind. & Eng. Chem. *25*, 817 (1933).

[423] Riesenfeld, Farber. Z. *30*, 13 (1919).

[424] Lomanovich, Vse. Nauch. Iss. Inst. Zhirov. 34 (1936).

[425] Schmittman, Ger. 696,126 (1940).

[426] Weill, Ger. 592,881 (1934).

[427] Sherwood Petroleum Co., Englewood, N. J.

[428] Redlich, Fr. 643,055 (1927).

[429] Tusler, Soap *6*, 33 (1929); Flint, U. S. 1,994,467 (1935).

[430] Synthetic Organic Chemicals (Carbide & Carbon Chem. Corp., N. Y. C.), p. 55 (1940).

[431] Minich, Textile Colorist p. 698 (1939).

[432] Synthetic Organic Chemicals (Carbide & Carbon Chem. Corp., N. Y. C.), p. 55 (1940).

[433] Synthetic Organic Chemicals (Carbide & Carbon Chem. Corp., N. Y. C.), p. 55 (1940).

[434] Catalog, Amer. Cyanamid & Chem. Corp., N. Y. C.

[435] Pocs, Hung. 101,357 (1930).

[436] Tusler, Oil & Fat Ind. *5*, 338 (1928).

[437] Lauro, Oil & Fat Ind. *5*, 329 (1928); Lee, Oil & Fat Ind. *6*, 15 (1929).

[438] Woburn Degreasing Co., Woburn, N. J.

[439] Kadmer, Seifen.-Z. *66*, 171 (1939).

[440] Schanzle, U. S. 2,091,886 and 2,091,887 (1937).

[441] Schanzle, U. S. 2,091,886 and 2,091,887 (1937).

[442] Schanzle, U. S. 2,091,886 and 2,091,887 (1937).

[443] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[444] Strother, U. S. 2,238,956 (1941).

[445] Harkins, Fifth Colloid Sympos. Monograph p. 19 (1928).

[446] I. G., Fr. 706,182 (1930).

[447] Emulsol, Fr. 705,000 (1930).

[448] Catalog, R. F. Revson Co., Englewood, N. J.

[449] Augustin, Soap *8*, 25, 67 (1932).

[450] Emulsol, Fr. 705,000 (1930).
[451] McKee, Chem. Met. Eng. *24,* 969 (1921).
[452] Harkins, Fifth Colloid Sympos. Monograph p. 19 (1928).
[453] du Pont, Brit. 531,195 (1939).
[454] Serralach, J. Ind. & Eng. Chem. *25,* 817 (1933).
[455] Henkel, Brit. 395,538 (1933).
[456] Strother, U. S. 2,238,956 (1941).
[457] Gunther, U. S. 1,843,420 (1932).
[458] Schrauth, Seifen.-Z. *58,* 61 (1931); Strother, U. S. 2,238,956 (1941).
[459] Catalog, Phila. Quartz Co., Phila., Pa.
[460] Weeks, Phys. Rev. *35,* 668 (1930).
[461] Catalog, Socony-Vacuum Co., N. Y. C.; Dittler, Seifen.-Z. *64,* 598a (1937); Minich, Textile Colorist p. 698 (1939).
[462] Harkins, Fifth Colloid Sympos. Monograph p. 19 (1928); Hart, Ind. & Eng. Chem. *21,* 86 (1929); Serralach, Ind. & Eng. Chem. *25,* 817 (1933).
[463] Tyutyunnikov, Allgem. Oel-u. Fett-Ztg. *28,* 165, 185 (1931).
[464] Hetzer, Chem.-Z. *64,* 160 (1940).
[465] Brit. 369,915 (1931).
[466] Pasternack, U. S. 1,890,948 (1932).
[467] Van der Meulen, J. Am. Chem. Soc. *46,* 876 (1924).
[468] Schuster, Ger. 543,350 (1925).
[469] Catalog, Diamond Alkali Co., Pittsburgh, Pa.
[470] Harkins, Fifth Colloid Sympos. Monograph p. 19 (1928).
[471] Strother, U. S. 2,238,956 (1941).
[472] Catalog, Atlas Powder Co., Wilmington, Del.
[473] Catalog, Atlas Powder Co., Wilmington, Del.
[474] Catalog, Atlas Powder Co., Wilmington, Del.
[475] Catalog, Atlas Powder Co., Wilmington, Del.
[476] Catalog, Atlas Powder Co., Wilmington, Del.
[477] Catalog, Atlas Powder Co., Wilmington, Del.
[478] Catalog, Atlas Powder Co., Wilmington, Del.
[479] Catalog, Atlas Powder Co., Wilmington, Del.
[480] Catalog, Atlas Powder Co., Wilmington, Del.
[481] Catalog, Atlas Powder Co., Wilmington, Del.
[482] Catalog, Atlas Powder Co., Wilmington, Del.
[483] Catalog, Atlas Powder Co., Wilmington, Del.
[484] Catalog, Atlas Powder Co., Wilmington, Del.
[485] Catalog, Atlas Powder Co., Wilmington, Del.
[486] Catalog, Atlas Powder Co., Wilmington, Del.
[487] Catalog, Atlas Powder Co., Wilmington, Del.
[488] Catalog, Atlas Powder Co., Wilmington, Del.
[489] Catalog, Atlas Powder Co., Wilmington, Del.
[490] Catalog, Glyco Products Co., Brooklyn, N. Y.
[491] Catalog, Glyco Products Co., Brooklyn, N. Y.
[492] Catalog, Glyco Products Co., Brooklyn, N. Y.
[493] Catalog, Glyco Products Co., Brooklyn, N. Y.
[494] Catalog, Glyco Products Co., Brooklyn, N. Y.
[495] Catalog, Glyco Products Co., Brooklyn, N. Y.
[496] Catalog, Glyco Products Co., Brooklyn, N. Y.
[497] Catalog, Glyco Products Co., Brooklyn, N. Y.

[498] Catalog, Glyco Products Co., Brooklyn, N. Y.
[499] Catalog, Glyco Products Co., Brooklyn, N. Y.
[500] Catalog, Glyco Products Co., Brooklyn, N. Y.
[501] Catalog, Glyco Products Co., Brooklyn, N. Y.
[502] Eddy, Trans. Ky. State Hort. Soc. p. 139 (1933).
[503] Rewald, Ger. 522,041 (1927).
[504] Watts, Ind. & Eng. Chem. *31*, 1282 (1939).
[505] Bryson, Synthetic & Applied Finishes *4*, 39, 50 (1933).
[506] Redgrow, Mfg. *12*, 38 (1941).
[507] Emulsol, Fr. 705,000 (1930).
[508] Harris, U. S. 1,917,249.
[509] Catalog, E. I. du Pont de Nemours & Co., Wilmington, Del.
[510] Janistyn, Fette v. Seifen *47*, 351 (1940).
[511] Clowes, J. Phys. Chem. *20*, 407 (1916).
[512] Clark, J. Biol. Chem. *52*, 157 (1922).
[513] Harris, U. S. 2,114,490.
[514] P. C.
[515] Ernotte, Belg. 395,761 (1933).
[516] Catalog, Warwick Chemical Co., West Warwick, R. I.
[517] Catalog, Warwick Chemical Co., West Warwick, R. I.
[518] Minich, Textile Colorist, p. 698 (1939).
[519] Muncie, U. S. 2,236,828.
[520] Hanford, U. S. 2,231,405 (1941).
[521] Albert, Aust. 72,451 (1916).
[522] Berend, Brit. 16,315 (1915).
[523] Bingham, Ind. Eng. & Chem. *17*, 952 (1925).
[524] I. G., Brit. 271,071 (1926).
[525] Jaeger, U. S. 2,028,091 (1936).
[526] Petrov, Brit. 289,934 (1927).
[527] Noll, Papier.-Fabr. *26*, 218 (1928).
[528] Brand, U. S. 2,216,180 (1940).
[529] Emulsol, Fr. 705,000 (1930).
[530] Oda, J. Soc. Chem. Ind. (Jap.) *35*, 515B (1932).
[531] I. G., Brit. 272,967 (1926).
[532] Clark, U. S. 2,006,309 (1935).
[533] I. G., Fr. 636,817 (1927).
[534] Fiero, J. Am. Pharm. Assoc. *30*, 145 (1941).
[535] Fiero, J. Am. Pharm. Assoc. *30*, 145 (1941).
[536] Fiero, J. Am. Pharm. Assoc. *30*, 145 (1941).
[537] Fiero, J. Am. Pharm. Assoc. *30*, 145 (1941).
[538] Fiero, J. Am. Pharm. Assoc. *30*, 145 (1941).
[539] Fiero, J. Am. Pharm. Assoc. *30*, 145 (1941).
[540] Hart, Ind. & Eng. Chem. *21*, 86 (1929).
[541] Catalog, Royce Chem. Co., Carlton Hill, N. J.
[542] Kroch, Brit. 387,542 (1933).
[543] Petroff, U. S. 1,230,599 (1917).
[544] Braddiley, Brit. 274,611 (1926).
[545] Sprenger, Bull. Soc. Ind. Mulhouse *89*, 601 (1923).
[546] Levinstein, U. S. 1,219,967 (1917).
[547] Catalog, Royce Chem. Co., Carlton Hill, N. J.

[548] Welwart, Seifen.-Z. *511,* 130 (1927); Kadmer, Seifen.-Z. *66,* 171 (1939).

[549] Nakazawa, Jap. 139,141 (1939).

[550] Bohme, Fr. 637,338 (1927).

[551] Sandoz, Swiss 160,937 (1933).

[552] I. G., Brit. 354,217 (1930).

[553] Bunbury, Brit. 354,417 (1930).

[554] Levinstein, U. S. 1,176,378; 1,185,213 (1916).

[555] Kizber, J. Chem. Ind. (Moscow) *5,* 1176 (1928).

[556] Kizber, Zhur. Khim. Prom. *5,* 1176 (1928).

[557] Catalog, Royce Chem. Co., Carlton Hill, N. J.

[558] Thauss, Ger. 531,296 (1926); I. G., Brit. 305,597 (1928).

[559] Gunther, U. S. 1,836,588 (1931).

[560] Schrauth, U. S. 1,750,198 (1930).

[561] I. G., Brit. 303,917 (1927).

[562] Bohme, Brit. 318,542 (1928).

[563] Bertsch, U. S. 1,968,793 (1934).

[564] Pfaff, Riechstoff Ind. *9,* 2 (1934); Catalog, Th. Goldschmidt Corp., N. Y. C.

[565] Karsten, Pharm. Presse *34,* 365 (1929); Pfaff, Riechstoff Ind. *9,* 2 (1934); Catalog, Th. Goldschmidt Corp., N. Y. C.

[566] Catalog, Th. Goldschmidt Corp., N. Y. C.

[567] Catalog, Carbide & Carbon Chemical Corp., N. Y. C.

[567a] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[568] Schrauth, Am. Perfumer *19,* 459 (1924).

[569] Catalog, General Chemical Co., N. Y. C.

[570] Pfaff, Riechstoff Ind. *9,* 2 (1934).

[571] Wilson, Ind. Eng. Chem. *22,* 143 (1930).

[572] Fischer, Allgem. Oel-u. Fett-Z. *32,* 489 (1935).

[573] I. G., Brit. 306,116 (1928).

[574] Minich, Textile Colorist, p. 698 (1939); Zimmer, U. S. 2,230,556 (1941).

[574a] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[575] Pollard, U. S. 2,206,046 (1940).

[576] Strother, U. S. 2,238,956 (1941).

[577] Catalog, Glyco Products Co., Brooklyn, N. Y.

[578] Catalog, Glyco Products Co., Brooklyn, N. Y.

[579] Harris, U. S. 2,099,796 (1935).

[580] Bennett, Soap *5,* 39; Bennett, Ind. & Eng. Chem. *22,* 1255 (1930).

[581] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[582] Mackay, Brit. 229,361 (1923).

[583] Catalog, Commercial Solvents Corp., Terre Haute, Ind.

[584] Catalog, Rohm and Haas Co., Inc., Philadelphia, Pa.

[585] Catalog, Rohm and Haas Co., Inc., Philadelphia, Pa.

[586] Catalog, Rohm and Haas Co., Inc., Philadelphia, Pa.

[587] Catalog, Rohm and Haas Co., Inc., Philadelphia, Pa.

[588] Catalog, Rohm and Haas Co., Inc., Philadelphia, Pa.

[589] Catalog, Glyco Products Co., Inc., Brooklyn, N. Y.

[590] Meyer, Brit. 365,844 (1931).

[591] Catalog, Advance Solvents & Chem. Corp., N. Y. C.

[592] Hodgins, U. S. 2,215,038 (1940).

[593] Hodgins, U. S. 2,215,038 (1940).

[594] Sando, U. S. 2,076,794.
[595] Pfaff, Riechstoff Ind. *9,* 2 (1934).
[596] Catalog, Warwick Chemical Co., West Warwick, R. I.
[597] Albertsen, Seifen.-Z. *65,* 121 (1938).
[598] Peter, Ind. & Eng. Chem. *22,* 1124 (1930).
[599] I. G., Brit. 287,464 (1927).
[600] Catalog, Fries Bros., N. Y. C.
[601] Catalog, Onyx Oil & Chemical Co., Jersey City, N. J.

CHAPTER IX

LIST OF EMULSIONS

THE emulsions in the following tables are listed according to special ingredients they contain. These special ingredients are arranged in alphabetical order. For more detailed information concerning the other ingredients of the emulsions and the technique used, see the references at the end of the list.

Acriflavine, petrolatum and mineral oil, with wool fat[1]

Acrylic nitrile and butadiene, with diethylamine-ethoxyoleylanilide hydrochloride[2]

Acrylic nitrile and butadiene, with sodium oleate[3]

Aliphatic or hydroaromatic alcohols, ketones, hydrocarbons, higher oleic acid or other fatty substances, aromatic bases or dyes with sodium dicresyl phosphate[5]

Amide, octadecyl, myristyl, or lauryl, with stearic acid and sodium silicate[6]

Amides, higher fatty, (e.g., stearamide) with sodium silicate and a higher fatty acid[7]

Amyl acetate and boric acid, with "Emulgor-A"[8]

Amyl alcohol, amyl acetate or ethylacetate, with iodine[9,10]

Aniline or dimethylaniline, with soap[11]

Aromatic principles, with ammonium sulforicinoleate[12]

Asphalt, with alkali and alkaline casein[13]

Asphalt, with alkali and clay[14]

Asphalt, with alkali phosphatides[15]

Asphalt, with alkali and soap or clay[16]

Asphalt, with alkali tannate[17]

Asphalt, with aluminum hydroxide and asbestine[18]

Asphalt, with ammonia and casein[19]

Asphalt, with bentonite[20]

Asphalt, with colloidal clay and anhydrous soap and olein[21]

Asphalt, with colloidal hydrous magnesium silicate[22]

Asphalt, with fatty acid and sodium or potassium carbonate[23]

Asphalt, with ferrous sulfate, potassium tannate and potassium caseinate[24]

Asphalt, with flaxseed mucilage [25]

Asphalt, with gelatin or glue [26]

Asphalt, with gelatin and salts [27]

Asphalt, with glue and soap [28]

Asphalt, with green petroleum acid soap and corn gluten, or soyabean meal [29]

Asphalt, with "Kontakt" or naphthenic acid [30]

Asphalt, with montan wax and caustic soda [31]

Asphalt, with naphthenic soap [32]

Asphalt, with oleic acid and borax or sodium silicate [33]

Asphalt, with oxidized paraffin wax soap [34]

Asphalt, with potassium tannate or caseinate [35]

Asphalt, with silica gel [36]

Asphalt, with soap and bentonite [37]

Asphalt, with soap or clay [38]

Asphalt, with soap and colloidal clay [39]

Asphalt, with soap, electrolytes or colloids [40]

Asphalt, with sodium abietate [41]

Asphalt, with sodium cresylate [42]

Asphalt, with sodium fatty alcohol sulfonates [43]

Asphalt, with sodium petroleum sulfonate [44]

Asphalt, with sodium phosphate [45, 46]

Asphalt, with sodium or potassium peroxide or percarbonate [47]

Asphalt, with sodium silicate and oleic acid [48]

Asphalt, with soya bean flour [49]

Asphalt, with starch, borax [50]

Asphalt, with starch or dextrin and alkali [51]

Asphalt, with stearin pitch and caustic soda [52]

Asphalt, with sulfate lignin and metallic salts [53]

Asphalt, with tannic acid or synthetic tannin [54]

Asphalt, with triethanolamine oleate and a salt [55]

Asphalt, with trisodium phosphate [56, 57, 58]

Asphalt, with wax acid metallic soap and caustic soda [59]

Asphalt, bitumen, coal-tar pitch, cresol or dead oil, with loam, soil or clay [60]

Asphalt and carbon tetrachloride, with colloidal clay [61]

Asphalt, cumarone resin and montan wax, with sodium or potassium hydroxides and methyl cellulose [62]

Asphalt and fatty acid, with alkali silicate or alkali borate [63]

Asphalt, fatty acids, oil or tar, with humic acids or humates [64]

Asphalt and fuel oil, with soap and metallic soap [65]

Asphalt and gasoline, with soap [66]

Asphalt, glycerides and mineral oil, with potassium soap [67]

Asphalt and montan wax, with alkali [68]

Asphalt or other bituminous material, with protein (casein), starch or oleic acid and alkali [69]

Asphalt or pitch, with bentonite and acid[70]

Asphalt or pitch, with naphthenic or fatty acid soap[71]

Asphalt or pitch, with petroleum and alkali[72]

Asphalt, pitch, and petroleum, with lead oxide[73]

Asphalt or pitch, with sulfonated fatty oils[74]

Asphalt or pitch, with sulfonated mineral oil[75]

Asphalt, pitch or rubber, with viscose[76]

Asphalt, pitch or tar, with colloidal clay and magnesiumoxide or hydroxide[77]

Asphalt residue or bitumen, with soap, rosin soap or rosin oil soap[78, 79]

Asphalt, resins, mineral oil, tar, vegetable or animal oils, with sulfonated fatty acids[80]

Asphalt and rosin oil, with sodium abietate[81]

Asphalt, rosin and petroleum pitch, with Turkey red oil[82]

Asphalt or tar, with cholesterol or soap[83]

Asphalt or tar, with lecithin or other phosphatides[84]

Asphalt, tar or pitch, with oil cake and alkali[85]

Asphalt, wax tailings and rosin, with colloidal clay[86]

Bakelite C-9 resins, with casein and ammonia and morpholine[87]

Balsam Peru with soap bark and saponin[88]

Beeswax, with potassium carbonate[89]

Beeswax and p-cymene, with ethyl cellulose[90]

Beeswax, Japan, or montan wax, with potassium carbonate[91]

Beeswax, stearine and ether, with ammonia[92]

Benzene with agar, saponin, albumin, pectin, gelatin, lecithin or casein[93]

Benzene, with castor oil soap, sodium oleate or coconut oil soap or kaolin[94]

Benzene, with colloidal ferric hydroxide[95]

Benzene, with methanol, ethanol, allyl alcohol, phenol, resorcinol or higher fatty acids[96]

Benzene, with phenol or resorcinol[97]

Benzene, gasoline, naphtha, or kerosene, with trihydroxyethylamine stearate[98]

Benzene and latex, with soap[99]

Benzene, nitrobenzene, chloroform or carbon tetrachloride and cottonseed oil, with gelatin[100]

Benzene, toluene, zylene, aniline, o-toluidine, nitrobenzene or dimethylaniline, with soap[101]

Benzine, with saponin[102]

Benzine and beeswax, with caustic soda and soap[103]

Benzine, benzene, petroleum, toluene, xylene, tetralin, decalin, hexalin, methyl hexalin, carbon tetrachloride or trichlorethylene, with

Turkey red oil, Monopole oil, ammonium oleate, triethanolamine, Lanette Wax SX, or Betan (sodium β-tetralin sulfonate)[104]

Benzine and benzol, with soap[105]

Benzine or mineral oil, with "Savonade" (Methyl hexalin and potassium oleate)[106]

Benzine or trichlorethylene with acidified carrageen, agar or Irish moss[107]

Benzoic-phthalic glyceride, with ammonia and gum arabic or gum tragacanth or Irish moss[108]

Bitumen, with acid sulfonated oil and alkali[109]

Bitumen, with alkali hydrolyzed glyceride[110]

Bitumen, with alkaline sulfonated oil[111]

Bitumen, with alkali salts of α or β naphthols, pyrogallol, resorcinol or carbazol[112]

Bitumen, with alkali tannate[113]

Bitumen, with bentonite[114]

Bitumen, with bentonite and calcium caseinate[115]

Bitumen, with blood[116]

Bitumen, with borax[117]

Bitumen, with calcium oxide and alum[118]

Bitumen, with calcium resinate and sodium resinate[119]

Bitumen (asphalt), with casein and alkali[120]

Bitumen, with chlorinated tall oil[121]

Bitumen, with formaldehyde phospho-protein condensation[122]

Bitumen, with humic acid and salt[123]

Bitumen, with humic or lignic acid[124, 125]

Bitumen, with hydrochloric acid and caustic soda[126]

Bitumen, with iron, aluminum or chromium sulfate and waste sulfate liquor[127]

Bitumen, with iron hydroxide, aluminum hydroxide, zinc hydroxide, basic magnesium salts or alkaline starch[128]

Bitumen, with lignic acid or oxidized tar extract[129]

Bitumen, with naphthenic or rosin soap and casein[130]

Bitumen, with protein or starch[131]

Bitumen, with rosin and alkali[132]

Bitumen, with rosin soap and milk[133]

Bitumen, with rosin soap and molasses[134]

Bitumen, with rubber latex[135]

Bitumen, with soap and alkaline casein and anthracene oil or creosote[136]

Bitumen, with soap and calcium resinate[137]

Bitumen, with soap and casein[138, 139]

Bitumen, with soap and gelatin[140]

Bitumen, with sodium hydroxide and sodium phenate[141]

Bitumen, with sodium oleate [142]
Bitumen, with sulfite liquor concentrate [143]
Bitumen, with sulfurized oils or sulfurized fatty acids [144]
Bitumen, with tall oil soap [145]
Bitumen, with water or alkali soluble phenol formaldehyde condensation [146]
Bitumen, with water swelling gum [147]
Bitumen or asphalt, with latex [148]
Bitumen or asphalt, with starch and alkali [149]
Bitumen, asphalt, petroleum or coal tar, with soap or rosin soap [150]
Bitumen and benzine, with barium chromate suspended in hot water [151]
Bitumen and gasoline, with potassium dichromate [152]
Bitumen or oil, with rubber latex [153]
Bitumen or pitch, with clay [154]
Bitumen, resin or wax, with sodium silicate [155]
Bitumen, resin and wax, with sulfite cellulose extract [156]
Bitumen, tar, creosote, or petroleum, with alkaline casein or alkaline blood albumin [157]
Bitumen, tar or pitch, with casein, rosin and caustic soda [158]
Bitumen and turpentine, with sodium hydroxide [159]
Bitumen and Vinsol resin, with alkali [160]
Borneol, terpene oil, fenchyl alcohol, with soft soap [161]
Butadiene, with diethylaminoethyloleylamide hydrochloride [162]
Butadiene, with (substituted) oleyl alcohol [163]
Butadiene, with saponin [164]
Butadiene, with sodium isoproplynaphthalenesulfonate [165]
Butadiene, with sodium and magnesium oleates [166]
Butadiene, with sodium oleate and magnesium oleate [167]
Butadiene, with sodium oleate, sodium isobutyl naphthalene sulfonate or albumin or diethylaminoethyloleylamide or 2-n-pentadecylglyoxaidine; sodium oleate [168, 169]
Butadiene, with sodium stearate [170]
Butadiene and butylene, with ammonia soap, glucosides or alginic acid [171]
Butadiene or isoprene, with salts of sulfonic or carboxylic acids or their amides [172]
Butadiene or isoprene, with sodium stearate [173]
Butadiene or styrene, with sodium stearate [174]
Butadiene and vinylidene chloride, with sodium oleate [175]
Butter, with egg white, gelatin, agar or gum arabic [176]
Butter, with lecithin [177]
Butter, with skim milk [178, 179]
Calcium sulforicinoleate, with gelatin or casein [180]
Camphor and acetaldehyde, with sodium oleate [181]

Carbon bisulfide, with alcohol and potassium oleate[182]

Carbon bisulfide, with potassium rosin fish oil soap or sodium rosin oleic acid soap[183]

Carbon bisulfide, with sulfonated castor oil[184]

Carbon bisulfide and butyl or amyl alcohol, with soap[185]

Carbon bisulfide or oils, with ammonia or amine and zinc, copper, or nickel hydroxide[186]

Carbon bisulfide and olein, with potash soap[187]

Carbon bisulfide and sulfur, with fish oil soap[188]

Carbon tetrachloride, with decylcarboxymethylisothiourea hydrobromide[189]

Carbon tetrachloride with triethylammoniumoleate[190]

Carbon tetrachloride, aniline, n-octanol, ethyl oleate, chloroform, benzene, toluene, xylene, higher paraffins, carbon bisulfide or hexane, with sodium oleate[191]

Carbon tetrachloride and benzene, with sodium oleate[192]

Carbon tetrachloride, benzene or camphor, with wool fat or sulfonated wool-fat fractions[193]

Carbon tetrachloride, chloroform, benzene, turpentine, almond or mineral oil, with gum tragacanth, gum acacia or Irish moss[194]

Carbon tetrachloride and cyclohexanol, with ammonium oleate[195]

Carbon tetrachloride and light oils, with saponin, soap or gum arabic[196]

Carbon tetrachloride, tetrachlorethane, trichlorethylene, tetrahydronaphthalene, benzene or naphtha, with sodium or ammonium sulforicinoleates[197]

Carnauba wax (bright drying), with alkanolamine soap[198]

Carnauba wax, with ammonia soap or glyceryl monostearate[199]

Carnauba wax, with morpholine oleate[200]

Carnauba wax, with soaps of monoethanolamine, diethanolamine, triethanolamine or morpholine[201]

Carnauba wax, with sodium and potassium stearates[202]

Carnauba wax, with trihydroxyethylamine-linoleate or stearate[203]

Carnauba wax and carbon tetrachloride, with lanolin and gelatin[204]

Carnauba wax and kerosene, with ammonium linoleate[205]

Carnauba and paraffin waxes, with starch[206]

Carnauba wax and resin, with soaps[207]

Carnauba wax and shellac, with borax and soap[208]

Castor, apricot or almond oils, with starch[209]

Cellulose nitrate and dibutyl phthalate, with gelatin[210]

Cetyl alcohol and shellac, with ammonia and triethanolamine[211]

2-Chlorbutadiene, with diisobutyl-naphthalene sulfonate and sodium oleate[212, 213]

Chlorobutadiene, with sodium oleate, quaternary ammonium salts or sodium fatty alcohol sulfonates[214]

Chlorobutadiene, with sodium oleate or sulfonated castor oil[215]
Chloroform, with silver dichromate[216]
Chloroprene polymers, with C-cetyl betaine[217]
Chloroprene or styrene, with partially saponified polyvinyl acetate or partially saponified formaldehyde polyvinyl acetal[218]
Chlorothymol, with alkaline casein[219]
Chlorothymol, with rosin soap[220]
Chocolate, with lecithin[221]
Cocoa butter, with gelatin and methyl cellulose[222]
Cocoa butter, with lecithin, cholesterol or cetyl alcohol[223]
Copper oleate and butanol, with sodium acetate[224]
Copper, zinc, silver, calcium, manganese or cobalt resinates, with ammonia and casein, soy protein or gelatin[225]
Cresol, with linseed oil soap[226]
Cresol, with sodium stearate[227]
Cresylic acid, with soap[228]
Cresylic acid, phenol, o-cresol, m-cresol, p-cresol, with potassium oleate[229]
Cyclohexanol, with soap[230]
Cyclohexanol or methyl cyclohexanol and tetralin or decalin, with lecithin[231]
Dibenzanthracene, benzanthracene, dihydroanthracene or chrysene, with gelatin[232]
Dibenzanthracene and pyridin, with gum acacia[233]
Dibutyl phthalate, with bentonite and soap[234]
Dichlorbenzene, cresol and camphor oil, with sulfonated oils[235]
Diethylene glycol abietate, with "Duponal ME," sulfated castor oil and soap[236]
Diethyleneglycol abietate, "Abalyn," or "Hercolyn," with alkaline casein with or without sulfonated oil and Dupanol[237]
Diethylphthalate, with soap[238]
Dimethylerythrene, with soap[239]
Dimethyl sulfide, with calcium humate[240]
Diolefins, with milk, glue or gelatin[241]
Diolefins (e.g., butadiene), with proteids, milk, dextrin, soap or sulfonates[242]
Diolefins, with soap or sulfonic acid salts[243]
Dipentene, with sodium butylnaphthalene sulfonate or sodium isopropylnaphthalene sulfonate[244]
Dyes, with bentonite and casein[245]
Egg yolk substitute, with lecithin and improved with hydrogen peroxide[246, 247]
Erythrene, isoprene or butadiene and styrene, with sodium stearate[248]
Ethanol-stearamide, with sodium silicate and higher-fatty acid[249]

Ether, ethyl acetate, amyl acetate and amyl alcohol, with iodine[250]

Ethylenedichloride, with magnesium hydroxide, starch, gelatin, glue or albumin[251]

Ethylenedichloride, with potash fish-oil soap[252]

Ethylenedichloride, with sulfonated sperm oil[253]

Ethylenedichloride and oleic acid, with diglycol oleate and ammonia[254]

Ethylenedichloride or trichlorethylene, with Turkey red oil and bentonite[255]

Fat, with egg yolk[256]

Fat, with gelatin[257]

Fat, with malt or malt extract[258]

Fat, with powdered gum arabic or tragacanth[259]

Fat, animal, with lecithin and skim milk[260]

Fat, edible, with skimmed milk, lecithin and malt extract[261]

Fats, butter and vegetable, with skim milk[262]

Flax wax, with sodium oleate or ethanolamine[263]

Furfural, engine-, paraffin oil or kerosene, with bentonite[264]

Gasoline, with alginic acid, casein and sodium silicate[265]

Gasoline, with copper oleate and ammonium nitrate[266]

Gasoline, with petroleum sulfonic acid[267]

Gasoline, with soap[268, 269]

Gasoline, with sodium, ammonium or triethylammonium oleate[270]

Gasoline, ether, benzene, or chloroform, with wool-fat fractions or their sulfonates[271]

Gasoline and eucalyptus oil, with soap[272]

Gilsonite, with tannic acid[273]

Gilsonite and hydrocarbon solvent, with glue[274]

Glyceryl phthalate (in solvent) with bentonite, soap or gelatin[275]

Glycol abietate, xylene and butanol, with sulfonated tallow and caustic soda[276]

Gum benzoin, with gum tragacanth[277]

Gum chicle, with bentonite, casein, sodium stearate, albumin, starch, flour or soap[278]

Gum, resin, rubber or wax and solvent with soap or sulfonated oil[279]

Gum sandarac, with ammonium oleate[279]

Gurjun balsam, with neutral sulfonated castor oil[280]

Heptane and carbon tetrachloride, with kaolin[281]

Hydrocarbons, with hydrocarbon sulfones and sulfonic acids[282]

Hydrocarbons, with naphthenic acids or naphthene sulfonic acids[283]

Hydrocarbons, oils or waxes, with one from each of two following groups: (A) protein, agar, saponin or bile; (B) starch, dextrin, rubber or vegetable glue[284]

Hydrocarbons or substituted hydrocarbons, e.g., trichlorethylene, with soap and silica gel [285]
Hydroxybiphenyl with Turkey red oil and diphenyl ether or guaiacol [286]
Isobornyl acetate, with methyl cellulose [287]
Isobutyl p-aminobenzoate (cycloform), with lanolin [288]
Isoprene, with ammonium oleate and casein [289]
Isoprene, with sodium or ammonium oleate or Turkey red oil [290]
Isoprene or butadiene, with albumin or soap or sodium isobutylnaphthalene sulfonate [291]
Isoprene and dibutyl fumarate, with Turkey red oil and sodium alkyl naphthalene sulfonate [292]
Isoprene and dimethylbutadiene, with albumin, gelatin or hemoglobin [293]
Isoprene or dimethyl butadiene, with ammonium or potassium oleate and casein or albumin [294]
Isoprene or erythrene, with diethylaminoethyloleylamide hydrochloride or diethylaminoethoxyoleylamide hydrochloride [295]
Japan wax, with soap [296]
Kerosene, with ammonium oleate [297, 298]
Kerosene (SO_2 extract), with arsenic compounds [299]
Kerosene, with butyl acetyl ricinoleate [300, 301]
Kerosene, with carbon black [302, 303, 304]
Kerosene with soap [305]
Kerosene, with sodium oleate, potassium stearate or potassium palmitate [306]
Kerosene, with sodium stearate [307]
Kerosene, and alkyl thiocyanates with triethanolamine oleate [308]
Kerosene or benzene, with arsenious sulfide or antimony trisulfide or silica [309]
Kerosene, and dibutyl phthalate, with soap [310]
Kerosene and linseed, with soap and starch [311]
Kerosene, olive or castor oil, with sodium oleate [312]
Kerosene or pine oil, benzine, toluene, or chlorinated solvents, with Duponols [313]
Kerosene, pyrethrum and methyl salicylate, with soap [314]
Lacquer, with gum ghatti and sodium isopropylnaphthalene sulfonate [315]
Lacquer, with reaction product of ethylene oxide and castor oil [316]
Lanolin, with calcium icthosulfonate [317]
Lard, butter, or olive oil, with egg yolk or albumin [318]
Lard and hydrogenated cotton seed oil, with acid sodium stearate [319]
Lard or mineral oil, with soap [320]
Lard and sesame oil, with caustic potash [321]
Lead arsenate, with oleic acid and triethanolamine [322]

Lead arsenate, soya bean oil, with lime [323]

Lethane, with sulfite lye [324]

Methylbutadiene, with soap [325]

Methylmethacrylate, monomeric, with Turkey red oil and sodium diisopropyl naphthalene sulfonate [326]

Montan wax, with magnesium sulfate and sodium silicate [327]

Naphthalene, chlorinated, with hydrogenated naphthalene [328]

Naphthalene, chlorinated, and decahydronaphthalene with sulfite-cellulose extract [329]

Naphthalene, hydrogenated, with sulfonated fat or sodium alkylated aromatic sulfonate [330]

Nicotine, with soap [331]

Nicotine, derris or pyrethrum extracts, with sulfonated petroleum [332]

Nitrobenzene, with polyiodides and electric current [333]

Nitrocellulose, with pectin or agar [334]

Nitrocellulose, with soap, sulfated terpene, or higher alcohol, gelatin, Igepon or sulfonated castor oil [335]

Nitrocellulose, with sodium resinate or sodium lauryl sulfate [336]

Nitrocellulose and cyclohexanone, with sodium oleate [337]

Nitrocellulose lacquer, with gelatin or sodium oleate [338]

Nitrocellulose, resin and solvent, with soap gelatin or alkaline casein [339]

Nitrocellulose and solvents, with alizarin oil [340]

Nitrocellulose, solvents and oils, with magnesium, calcium or barium soaps and resins, e.g., dammar [341]

Nitrocellulose and wood creosote, with gum tragacanth [342]

Octane, with sodium oleate [343]

Oil, with ammonia soap [344]

Oil, with bentonite and soap [345]

Oil, with bentonite and vegetable gum [346]

Oil, with blood-albumen and ammonia [347]

Oil, with cetyl or stearyl alcohol and sulfated higher fatty alcohol sodium salt [348]

Oil, with lecithin [349]

Oil, with lecithin and hydrogen peroxide [350]

Oil, with silica, clay or iron oxide [351]

Oil, almond, with gum arabic and magnesium carbonate [352]

Oil, almond, and beeswax, with a higher aliphatic acid ester of an aliphatic polyhydroxy substance and an aliphatic polycarboxylic acid [353]

Oil, anthracene, with sulfite cellulose extract [355]

Oil, anthracene, or wood; or chlorine compounds, with bentonite [356]

Oil and bitumen, with acetylene [357]

Oil, blubber, with soda ash [358]

Oil, camphor with soap[359]

Oil, castor, with agar[360]

Oil, castor (blown), with ammonium ricinoleate[361]

Oil, castor, with gelatin[362]

Oil, castor, with gum acacia[363]

Oil, castor, with linseed and castor oil soap[364]

Oil, castor, with sodium hydroxide, or milk magnesia; gelatin and sugar[365,366]

Oil, castor, with sodium hydroxide or potassium hydroxide[367]

Oil, castor, with tannin[368]

Oil, castor, almond, cod liver, cottonseed, linseed, olive, or sesame, with gum acacia[369]

Oil, castor, carbon disulfide and alcohol, with potassium hydroxide[370]

Oil, hydrogenated castor, with triethanolamine stearate[371]

Oil, castor, linseed, cod liver or cottonseed, with gum arabic[372]

Oil, castor (blown), and mineral oil, with ammonia[373]

Oil, castor and mineral, with pectin[374]

Oil, castor or olive, with morpholine[375]

Oil, castor, olive or cod liver, with soap or calcium or barium hydroxide[376]

Oil, castor, rapeseed, and turpentine, with ammonia[377]

Oil, coal-tar, with sulfonated castor oil[378]

Oil, coal-tar, creosote, tar, petroleum, pitch, bitumen or asphalt, with casein, rosin and caustic soda or potash[379]

Oil, coconut, with casein and ammonia[380]

Oil, coconut, with flour or starch[381]

Oil, coconut, with gelatin[382]

Oil, coconut, with (skim) milk[383,384]

Oil, coconut, with soap[385]

Oil, coconut, with soya bean phosphatide[386]

Oil, coconut, cottonseed or peanut, or butter, with cetyl alcohol and milk[387]

Oil, coconut or peanut, with polyglycerol ester, lecithin or glyceryl laurate[388]

Oil, coconut, and stearin, with milk[389]

Oil, coconut and "Vaseline," with caustic soda[390]

Oil, cod liver, with alkali metaphosphate[391]

Oil, cod liver, with calcium phosphorus organic complex and gum acacia[392]

Oil, cod liver, with gum arabic[393]

Oil, cod liver, with methylcellulose[394]

Oil, cod liver, with pectin[395]

Oil, cod liver, with protalbic acid[396]

Oil, cod liver, with protalbic acid, casein, calcium, saccharate egg yolk and lime water [396,397,398,399]

Oil, cod liver, with soap, gum arabic and gelatin [400]

Oil, cod liver, with sodium metaphosphate, tragacanth and gum arabic [401]

Oil, cod liver, with sodium silicate and aluminum sulfate [402]

Oil, cod liver, or olive, with alkali casein [403]

Oil, cottonseed, with alkali soaps [404]

Oil, cottonseed, with gum acacia [405]

Oil, cottonseed (hydrogenated), with lecithin and triethanolamine [406]

Oil, cottonseed, with milk or gum arabic [407]

Oil, cottonseed, with pectin [408]

Oil, cottonseed and calcium carbonate, with "Emulgor A" and oleic acid [409]

Oil, cottonseed or corn, with sodium stearate or ammonium stearate [410]

Oil, cottonseed, corn, linseed, olive, rapeseed, peanut, sesame, castor or sperm, with soap [411]

Oil, cottonseed or mineral, or turpentine or benzene or carbon tetrachloride or chloroform or hexane, with gum acacia or soap [412]

Oil, cottonseed or other vegetable oil, with sulfonated coconut and castor oils [413]

Oil, cottonseed or red engine, with p-dichlorbenzol and sodium bicarbonate [414]

Oil, cottonseed, and tallow, with soap [415]

Oil, cranberry seed, with ursolic acid [416]

Oil, creosote, with gelatin [417]

Oil, creosote, with Nekal A.E.M. (glue and sodium isopropylnaphthalene sulfonate) [418]

Oil, creosote, with rosin soap [419]

Oil, creosote, with sodium hydroxide [420]

Oil, diesel, with bentonite [421]

Oil, dill weed, with gum tragacanth [422]

Oil, drying (e.g., linseed oil), with alkaline casein [423]

Oil, drying, with glue [424]

Oil, drying, with sodium hexametaphosphate [425]

Oil, drying, with triethanolamine soaps [426]

Oil, drying, and resins, or varnish, with sodium alginate [427]

Oil, egg yolk, with lecithin and cholesterol [428]

Oil, essential, with albumin and potassium bitartrate [429]

Oil, essential, with potassium oleate, triethanolamine linoleate or ammonium ricinoleate sulfate [430]

Oil, essential, with skim milk [431]

Oil, essential, with sugar solutions [432]
Oil, essential, with sulfonated fatty oil [433]
Oil, essential or ethereal, or salol, with Turkey red oil sulfonaphthenic acids or purified sulfite cellulose liquor [434]
Oil, essential, and stearopten, with soft soap [435]
Oil, eucalyptus, with rosin soap [436]
Oil and fat, with albumin [437]
Oil or fat, with aluminum hydroxide and urea [438]
Oil or fat, with esters of sulfo-fatty acids and albumin or glue [439]
Oil or fat, with glycerin and starch [440]
Oil or fat and solvent and radioactive substance, with caustic soda [441]
Oil, fatty, with chlorhydrin or diethylene dioxide [442]
Oil or fatty acid, with soyabean phosphatides or lecithin [443]
Oil, fish, with casein and disodium phosphate [444]
Oil, fish, asphalt, petroleum, coal-tar pitch, or cresol, with sulfite cellulose lye and colloidal silica [445]
Oil, fish or whale, with rosin soap [446]
Oil, flavoring, with gum acacia [447]
Oil, fuel, with clay or soap [448]
Oil, fuel, with starch or casein emulsion [449]
Oil, fuel, or coal, with nitrogen monoxide and casein or starch [449, 450]
Oil, fuel or kerosene, with alkali—or triethanolamine soap [451]
Oil, gas, with naphthenic soap [452]
Oil and glycol or glycol ether, with sulfonated oil [453]
Oil, hop extract, with malt syrup [454]
Oil, hydrogenated vegetable, with polymerized and oxidized glycerides [455]
Oil, linseed, with animal blood [456]
Oil, linseed, with antimony chloride [457]
Oil, linseed (boiled), with Duponol WA and caustic potash [458]
Oil, linseed, with egg albumin [459]
Oil, linseed, with glue and soda ash [460]
Oil, linseed, with potassium linoleate [461]
Oil, linseed, with sodium resinate and ammonium sulfate [462]
Oil, linseed, with sugar and starch [463]
Oil, linseed, butadiene and oleic acid, with Turkey red oil [464]
Oil, linseed, castor or soya bean, with ethanolamine oleate or hydroxyethylamine naphthenate [465]
Oil, linseed or castor, turpentine and cellulose acetate, with gelatin, glue and casein solution [466]
Oils, linseed and China wood, with casein, glue and flour [467]
Oil, linseed, China wood and gilsonite, with rosin soap [468]
Oil, linseed, and p-chlormetacresol, with potassium soap [469]

Oil, linseed, ester gum, and rosin, with triethanolamine[470]

Oils, linseed and mineral, with antimony chloride[471]

Oil, linseed, and oleic acid, with china clay, fullers' earth or bentonite[472]

Oil, linseed, poppy or soya bean with soap, saponin, sulforicinates, carragheen moss or gelatin[473]

Oil, linseed, "Pyroxylin," butyl acetate and gasoline, with sodium oleate[474]

Oil, linseed, and rosin, with glue[475]

Oil, linseed, tallow and rosin, with sodium hydroxide[476]

Oil, lubricating (no added emulsifier)[477]

Oil, lubricating, with bentonite[478]

Oil, lubricating, with calcium oxide[479]

Oil, lubricating, with electric discharge[480]

Oil, lubricating, with kaolin, glue or skim milk[481]

Oils, lubricating and pine, with sodium naphthenate[482]

Oil, marine, with disodium hydrogen phosphate[483]

Oil, mineral, with agar[484]

Oil, mineral, with agar and acid[485]

Oil, mineral, with agar; malt extract; casein or egg yolk; psyllium-seed, agar, and gelatin[486, 487, 488, 489, 490]

Oil, mineral, with alkali metal naphthenate and monethyl ether of ethylene glycol[491]

Oil, mineral, with alkali soap of sulfonated oil and glue[492]

Oil, mineral, with aluminum naphthenate and partially esterified glyceryl oleate[493]

Oil, mineral, with ammonium laurate[494]

Oil, mineral, with barium hydroxide[495]

Oil, mineral, with barium soap[496]

Oil, mineral, with basic copper sulfate, basic ferrous sulfate, basic nickel sulfate, ferrous hydroxide or ferric hydroxide[497]

Oil, mineral, with bentonite[498, 499]

Oil, mineral, with calcium stearate[500]

Oil, mineral, with cyclohexylamine oleate[501]

Oil, mineral, with diglycol laurate, diglycol oleate or sodium oleyl sulfate[502]

Oil, mineral, with dioctadecenyl ether of trioxytriethylamine-acetate[503]

Oil, mineral, with fullers' earth[504]

Oil, mineral, with glue and sodium oil soluble mineral sulfonate[505]

Oil, mineral, with glyceryl monooleate or glyceryl naphthenate[506, 507]

Oil, mineral, with glycerylmonooleate and mahogany soap[508]

Oil, mineral, with gum acacia and tragacanth or agar[509]

Oil, mineral, with heptadecylamine hydrochloride and trisodium phosphate, sodium sulfate, palmitic acid, sodium tannate or 3N hydrochloric acid[510]

Oil, mineral, with lignosulfonic acid[511]

Oil, mineral, with lime water (calcium hydroxide sol'n.)[512]

Oil, mineral, with (skim) milk or diglycol laurate[513]

Oil, mineral, with monostearin and sodium stearate[514]

Oil, mineral, with montan wax[515]

Oil, mineral, with naphthalene sulfonic acid[516]

Oil, mineral, with naphtylamine or quinol[517, 518]

Oil, mineral, with nonaethylene glycol dioleate[519]

Oil, mineral, with oxidized naphthenic hydrocarbons[520]

Oil, mineral, with petroleum sulfonates (water soluble)[521]

Oil, mineral, with phosphorized and sulfurized lard oil, Twitchell reagent and diethylene glycol[522]

Oil, mineral, with polyhydric alcohols partially esterified with higher fatty acids[523]

Oil, mineral, with polymerized oil ("Voltol"), wool fat or woolfat alcohols[524]

Oil, mineral, with saponified sulfonated oil soap[525]

Oil, mineral, with saponified sulfonated sperm oil[525]

Oil, mineral, with sodium cetyl sulfate, cholesterol, oleyl alcohol, elaidyl alcohol, cetyl alcohol, sodium stearate, sodium elaidate, sodium oleate, cetyl sulfate, cetyl sulfonate, sodium palmitate, cetyltrimethyl ammonium bromide, sodium taurocholate, sodium glycocholate or sodium desoxycholate[526]

Oil, mineral, with sodium oleate, arabic acid, sodium, magnesium or iron arabate, sodium or ammonium valerate, sodium galactonate, sodium dihydroxy stearate, sodium salicylate or sodium gallate[527]

Oil, mineral, with sodium oleate or haemoglobin[528]

Oil, mineral, with sodium oleate or Turkey red oil[529]

Oil, mineral, with sodium petroleum sulfonate and sodium rosinate[530]

Oil, mineral, with sodium salt of sulfated fish oil[531]

Oil, mineral, with sodium, and triethanolamine naphthenates[532]

Oil, mineral, with soya bean albumin and soda ash[533]

Oil, mineral, with starch, dextrin, and flour or gum senegal, or gum arabic with gum tragacanth or karaya[534]

Oil, mineral, with sulfonated castor oil or caustic alkali and olein, rosin or rosin oil, ammonia and alcohol[535]

Oil, mineral, with sulfonated castor oil, neutralized (Turkey red oil)[536]

Oil, mineral, with sulfonated fatty alcohol salt[537]

Oil, mineral, with triethanolamine sulfonate[538]

Oil, mineral and acetic acid (glacial), with "Emulgor A" and oleic acid [539]

Oil, mineral and aluminum chloride, with "Emulgor A" and oleic acid [540]

Oils, mineral and animal, with sulfurized unsaturated oil [541]

Oil, mineral, animal or vegetable, with lead salt of sulfated higher fatty alcohol [542]

Oil, mineral, benzene or olive oil, with sodium oleate, saponin or triethanolamine oleate [543]

Oil, mineral, butanol, with naphthenic soap [544]

Oil, mineral, and butanol, with sulfonated oleic acid sodium salt [545]

Oil, mineral, castor or olive, with saponin or sodium oleate, or gum tragacanth or sodium glycocholate or gum acacia [546]

Oil, mineral and citric acid, with "Emulgor A" and oleic acid [547]

Oil, mineral, creosote, with oil soluble mineral oil sulfonates [548]

Oil, mineral, and cresol, with fish oil soap [549]

Oil, mineral, and cresol, with sodium naphthenate [550] .

Oil, mineral, decalin, olein cyclohexanol and turpentine, with soap [551]

Oil, mineral, and dinitro-o-cyclo-hexylphenol, with blood albumin [552]

Oil, mineral, fatty acid, carbon disulfide, turpentine or chlorinated hydrocarbons, with olein, soap and cyclohexanol [553]

Oil, mineral, fatty acids (vegetable or animal) and gas oil, with castor oil soap [554]

Oils, mineral and fish, with ammonium soap [555]

Oil, mineral and formic acid, with "Emulgor A," oleic acid and glaurin [556]

Oil, mineral, and hexalin, with mahogany sulfonates and gelatin [557]

Oil, mineral, and hydrocarbon gas, with bentonite [558]

Oil, mineral and hydrochloric acid, with "Emulgor A" and glaurin [559]

Oil, mineral or mustard, with pectin [561]

Oil, mineral, and naphthenic acid, with sulfonated naphthenic acid [562]

Oil, mineral, nicotine petroleum sulfonate, with soap [563]

Oil, mineral, and nicotine sulfate, with bentonite or diglycol oleate [564]

Oil, mineral, and oleic acid, with lime and soda ash [565]

Oil, mineral, and oleic acid, with sodium salts of petroleum sulfonates [566]

Oil, mineral, and oleic acid or naphthenic acid or alcohol rosin solution, with sodium petroleum sulfonates [567]

Oils, mineral and olive, with soap and sulfonated castor oil [568]

Oil, mineral, olive or castor, with sulfonated higher fatty alcohol [569]

Oil, mineral or olive, or oleine, with "Nekal A.E.M."[570]

Oil, mineral, or other hydrocarbons and alcohol, with nascent hydrogen[571]

Oil, mineral, and oxidized mineral oil, with potash soap[572]

Oil, mineral and oxyquinoline sulfate, with "Emulgor A" and oleic acid[573]

Oil, mineral, and phenol, with sodium resinate[574]

Oil, mineral and phosphoric acid, with "Emulgor A" oleic acid and glaurin[575]

Oils, mineral and pine, and turpentine, with calcium soap[576]

Oil, mineral, and rosin, with catechu or other tannin[577]

Oil, mineral and sodium chloride, with "Emulgor A"[578]

Oil, mineral and sulfuric acid (conc.), with "Emulgor A," oleic acid and glaurin[579]

Oils, mineral and tall, with alkali[580]

Oil, mineral or tar, with colloidal graphite, magnesium, oxide or carbonate[581]

Oil, mineral or tar, with glue and urea[582]

Oil, mineral or tar, with sulfite lye and caustic potash[583]

Oils, mineral and tar-acid, and isopropanol, with oil soluble petroleum sulfonate[584]

Oil, mineral and tartaric acid, with "Emulgor A" and oleic acid[585]

Oil, mineral and terpinyl acetate, with soap[586]

Oil, mineral, and turpentine, with antimony chloride[587]

Oils, mineral and vegetable, with soap and sulfonated oil[588]

Oil, mustard or lemon, with gum acacia[560]

Oil, neatsfoot, with aluminum hydroxide[589]

Oil, neatsfoot, with diethyloctylamine hydrochloride[590]

Oil, neatsfoot, with sulfonated cod oil and soap[591]

Oil, neatsfoot, with sulfonated neatsfoot oil and egg yolk or egg white[592]

Oils, neatsfoot and mineral, with sulfonated neatsfoot oil[593]

Oil, neatsfoot, train, bone, or rapeseed, with methyl cellulose[594]

Oil, olive, with ammonium oleate[595]

Oil, olive, with casein[596]

Oil, olive, with (alkaline) casein[597]

Oil, olive, with castor oil soap[598]

Oil, olive, with (skim) milk[599]

Oil, olive, with milk and egg yolk or starch[600]

Oil, olive, with oleyldiethylethylene diamine hydrochloride[601]

Oil, olive, with sodium oleate[602]

Oil, olive, and beef suet, with Irish moss[603]

Oil, olive or castor, with colloidal clay and alkali[604]

Oil, olive, castor, cedar or cod liver, with medicinal plant infusions, e.g., absinth or mint[605]

Oil, olive, castor, linseed or mineral, oleic acid, paraffin wax, higher alcohols, ketones or esters, with soap and glue, gelatin or gum arabic, in place of the soap, saponin or concentrated sulfite liquor can be used[606]

Oil, olive or cod liver, with sodium silicate[607]

Oil, olive, and paraffin wax, with glue[608]

Oil, olive, peanut, or cottonseed, with alkaline casein[609]

Oil, olive, peanut, cottonseed, or soya bean, lard, oleo or hydrogenated oils (castor, cod liver, or mineral oil), with raw egg, egg-white, egg yolk or dried egg[610, 611]

Oil, olive, peanut or other oils, with sulfonated oils, fats or fatty acids[612]

Oil, olive, sperm, castor, poppy or cod liver, with casein[613]

Oil, olive or sweet almond, with gum tragacanth or gum arabic[614]

Oil, olive, and tallow, with potassium carbonate[615]

Oil, oxidized drying, with sodium hydroxide or ammonia[616]

Oil, palm, with Duponol ME, cetyl alcohol and borax[617]

Oil, palm, with triethanolamine and tall oil[618]

Oils, palm and mineral, with soap[619]

Oil, palm and tallow or rapeseed oil, with sodium carbonate[620]

Oil, paraffin, with gelatin or Sapamine MS[621]

Oils, paraffin and fish, with soap and ammonia[622]

Oil, paraffin, benzene, nonyl alcohol or undecyl alcohol, with sodium oleate[623]

Oil, paraffin or cod liver, with "Tylose" (methyl cellulose)[624]

Oils, paraffin and linseed, turpentine and ether, with ammonia[625]

Oil, peanut, with ammonia[626]

Oil, peanut, with egg white and milk[627]

Oil (hardened), peanut, with milk and egg yolk proteins[628]

Oil, peanut, with oleyl or cetyl adipate[629]

Oil, pine, with alkali and amine soap[630]

Oil, pine, with alkali soap and amine soap[630]

Oil, pine, with soya bean flour and soap[631]

Oil, pine and hydrochloric acid, with "Emulgor A" and oleic acid[632]

Oil, pine and sodium chloride, with "Emulgor A"[632]

Oil, pupa, with sodium oleate, gum arabic or dextrin[633]

Oil, rapeseed, with milk curds[634]

Oil, rapeseed, turpentine, oil of amber and camphor with soft soap and ammonia[635]

Oil or resin with glue or egg yolk[636]

Oil, sardine, with sulfonated naphthenic acid salt[637]

Oil, sesame, with polyglyceryl oleate[638]

Oil, shale, with lime[639]

Oil, shale distillate, with sulfite liquor, soap, glue, calcium caseinate or bentonite[640]

Oil, soya bean, with caustic and alum[641]

Oil, sperm, with glyceryl monostearate and sodium oleyl sulfonate[642]

Oil, sulfurized, with gelatin, casein, soap or saponin[643]

Oil, sulfurized colza, with saponin or soap[644]

Oil, tall, with soap and aniline[645]

Oil, tar, asphalt or rubber, with aromatic or hydroaromatic sulfonic acids or their alkali, calcium or magnesium salts[646]

Oil, tar, asphalt or rubber, with sodium petroleum sulfonates[647]

Oil, ti-tree, with cetyl alcohol[648]

Oil, train, neatsfoot, or mineral, or wool fat with methyl cellulose[649]

Oil, turpentine, with gelatin, water, glycerin, sucrose and tartaric acid[650]

Oil, vegetable, with ammonia and insecticide[651]

Oil, vegetable, with casein and alkali or amine[652]

Oil, vegetable, with egg yolk[653]

Oil, vegetable, with glycerylmono and distearates[654]

Oil, vegetable, with lecithin and alkali peroxide[655]

Oil, vegetable, with (skim) milk[656]

Oil, vegetable, with milk and partially oxidized soya bean oil[657]

Oil, vegetable, with polyhidric alcohol partially esterified with higher fatty acid[658]

Oil, vegetable, with sodium potassium or ammonium soaps[659]

Oil, vegetable, with starch and gum arabic or tragacanth[660]

Oil, vegetable, or fat, with pectin[661]

Oil, vegetable, or fatty acid, with vegetable phosphatides[662]

Oil, vegetable, fish or mineral, and boiled linseed oil, with maltose[663]

Oil, vitamin, concentrate, with gum arabic, pectin or agar[664]

Oil, volatile, creosote or thymol, with rosin soap[665]

Oil, waxes or resins, with ammonium linoleate[666]

Oleic acid, with ammonium oleate[667]

Oleic acid, with sodium oleate[668]

Oleic acid, with triethanolamine salt of oleyl sulfate[669]

Oleic acid, cyclohexanol, aniline or benzol, with ditolyl sodium phosphate[670]

Olein with cetyl glucoside and Turkey red oil[671]

Olein, with methyl cellulose and sulfated lauryl alcohol[672]

Paraffin wax, with calcium oleate[673]

Paraffin wax, with diethylamine oleate[674]

Paraffin wax, with (higher) fatty acid amide[675]

Paraffin wax, with gelatin[676]

Paraffin wax, with glue, alumina-gel, gelatin, soap[677, 678, 679, 680]

Paraffin wax, with gum ghatti[681]

Paraffin wax, with gum tragacanth[682]

Paraffin wax, with rubber latex[683]

Paraffin wax, with saponified montan wax[684]

Paraffin wax, with soap[685]

Paraffin wax, with sodium salt of petroleum sulfonic acid[686]

Paraffin wax, with sodium soaps of stearic, palmitic, ricinoleic or cerotic acid[687]

Paraffin wax, with soybean protein[688]

Paraffin wax, with sulfite cellulose extract and clay[689]

Paraffin wax, with trihydroxyethylamine stearate[690]

Paraffin wax and aluminum acetate, with "Emulgor A," oleic acid and glaurin[691]

Paraffin and beeswax and gum elemi, with sodium hydroxide[692]

Paraffin wax, beeswax, tallow, olive oil or oleic acid with Lamepone A[693]

Paraffin wax and benzene, with soap[694]

Paraffin wax and benzol with alkali casein and rosin[695]

Paraffin wax, bitumen, oil or fat, with degraded starch[696]

Paraffin wax and carbon tetrachloride, with gelatin, glue or gum tragacanth[697]

Paraffin or ceresin wax, with soap and glue, albumin, casein, China clay or amines[698]

Paraffin, esparto, candelilla, wool, or montan wax and rosin with caustic soda[699]

Paraffin wax and esparto, wool or montan wax, with rosin soap[700]

Paraffin wax and linseed oil, with albumin[701]

Paraffin or montan wax, with corn oil soap and starch[702]

Paraffin wax and montan wax, with rosin soap and alkali[703]

Paraffin, montan, ceresin, spermaceti, or ozokerite wax, with cetyl alcohol, wool-fat alcohol, mono- or di-glycerides with or without soap[704]

Paraffin wax and oil, with alkali fatty acid soap and glue[705]

Paraffin wax or oil, with sodium dodecyl sulfate and lauryl pyridinium bisulfate[706]

Paraffin wax and phenol-formaldehyde resin, with sulfonated sperm oil and soap[707]

Paraffin wax or resins, with glue or starch[708]

Paraffin wax and rosin, with rosin soap[709]

Paraffin wax and shellac, with soap[710]

Paraffin wax and wool grease, with blood albumin[711]

Peat, with calcium oxide[712]

Petrolatum, with agar[713]

Petrolatum, with Turkey red oil[714]

Petrolatum, with wool wax [715]

Petrolatum and beeswax or stearic acid, with sodium salt of sulfonated hydrogenated castor oil or sulfonated castor oil [716]

Petrolatum and ceresin, with slaked lime [717]

Petrolatum or fat with phytosterols [718]

Petrolatum and tallow, with Turkey red oil soap [719]

Petroleum (cylinder), with calcium oxide [720]

Petroleum, with casein [721]

Petroleum, with ethanolamine dihydroxystearic acid [722]

Petroleum, with oil soluble sulfonated naphthenic acid [723]

Petroleum, with sodium petroleum sulfonate [724]

Petroleum, with sulfonated peanut oil and copper soap [725]

Petroleum, with sulfonated sodium salt [726]

Petroleum or coal tar pitch, with ammonium alginate [727]

Petroleum distillate, with condensation product of sulfonated oil and glycol or glycerol [728]

Petroleum, and moellon, with wool grease and soap [729]

Petroleum, pitch or bitumen, with sodium chloride or glycerol [730]

Petroleum residue, with starch [731]

Petroleum residue or gasoline, with sea water [732]

Petroleum, turpentine, chloroform, ethyl chloride, ethyl bromide, ionone, terpineol, nitrobenzene aldehydes, pyridic or quinolic bases, tar, essential oils, bone oil, phenols, or naphthols, with sodium soap of castor oil [733]

Phenanthrene, retene, picene or chrysene, halogenated, with soap, amine soap, gum arabic, starch, bentonite saponified montan wax or casein [734]

Phenol or cresol, with sodium sulfonates of shale tar [735]

Phenol and toluol, with sodium oleate [736]

Pitch, with bentonite [737]

Pitch, with chrome green [738]

Pitch, with soap and alkaline casein [739]

Pitch, with starch and tannic acid or quebracho [740]

Pitch, asphalt, resin or rubber, with bentonite [741]

Pitch, coal-tar, with ammonia [742]

Pitch, coal-tar, or asphalt, with clay [743]

Pitch, stearin and bitumen, with caustic soda or potash [744]

Pitch or tar, with sodium metasilicate [745]

Polyisobutylene and carbon tetrachloride, with sodium oleate and casein [746]

Polyvinyl compounds, with rosin soap [747]

Polyvinylisobutyl ether or polyvinylethylether, with ammonia and casein [748]

Pyrethrum extract, with sulfonated aromatic compounds [749]

Pyrethrum solution, with triethanolamine abietate [750]

Resin, with alkaline casein [751]

Resin, alkyd, with ammonia and casein [752]

Resin, alkyd, with ammonium diisopropyl naphthalene sulfonic acid [753]

Resin, alkyd, with casein and alkalies [754]

Resin, alkyd, with inorganic alkalies or organic bases [755]

Resins, alkyd and maleic with casein, ammonia and montan wax [756]

Resin, cellulose ester, with gum ghatti and sodium isopropylnaphthalene sulfonate [757]

Resin, cumarone, with sodium silicate [758]

Resin, cumarone, with triethanolamine and oleic acid [759]

Resin, cumarone-indene, with sodium silicate [760]

Resin, cumarone, and solvent, with Turkey red oil [761]

Resin, ethyl acrylate or styrene, with sodium isopropyl naphthalene sulfonate [762]

Resin, ethyl or benzyl cellulose, and solvent, with alkaline casein and sulfonated vegetable oil [763]

Resin "Glyptal" solvent and rubber, with bentonite and soap [764]

Resin, ethylcellulose, butyl acetate octyl acetate and toluol, with Deceresol O.T. (10%) [765]

Resin, methyl acrylate, with sodium isopropyl-naphthalene sulfonate or sulfonated castor oil [766, 767]

Resins, methyl-methacrylate and allyl-methacrylate, with coconut oil soap [768]

Resins, methyl-methacrylate, butyl-methacrylate, dammar and dibutyl-phthalate, with sodium decanolsulfate [769]

Resin, Neville, with triethanolamine oleate and trisodium phosphate [770]

Resin or oil with dry precipitated silicic acid [771]

Resin, paracumarone, with sodium silicate [772, 773]

Resin, phenol-formaldehyde, with ammonia casein and methylcyclohexanol stearate [774]

Resin, phenol-formaldehyde (partially reacted), with casein and alkali [775]

Resin, phenol-formaldehyde, with formaldehyde-phenol sulfonic acid [776]

Resin, phenol-formaldehyde, with gum ghatti or arabic [777]

Resin, phenol-formaldehyde, with sodium hydroxide and gum arabic [778]

Resin, phenol-formaldehyde, and benzene, with bentonite and sodium oleate [779]

Resin, polyvinyl acetate, with polyglycol laurate [780]

Resin, synthetic, e.g., tung oil and maleic anhydride resin, with ammonia, sulfonated oils, soaps or wool-fat acids and gum tragacanth or colloidal clay [781]

Resins or terpenes, with ammonium sulforicinoleate[782, 783]

Resin, thermoplastic, with soap[784]

Resin, urea-formaldehyde, with sulfated ricinoleic acid and naphthalene salts[785]

Resin, vinyl, with glue[786]

Resin, vinyl copolymer, and benzol, with Alkanol B[787]

Resin, vinyl, and toluene, with glue[788]

Rosin, with mono-, di-, or tri-hydroxyethylamine or hydroxyethyl alkylamines[789]

Rosin, with isobutylnaphthalenesulfonic acid[790]

Rosin, with rosin soap[791, 792]

Rosin, with soda ash[793]

Rosin, with soda ash, sodium bicarbonate and ammonia[794]

Rosin, with sodium caseinate[795]

Rosin, with sodium hydroxide[796]

Rosin, with sodium-, potassium-, or ammonium-, lauryl, cetyl, or octadecyl sulfate[797]

Rosin acids, with glue or gum arabic[798]

Rosin and benzine, with rosin soap[799]

Rosin, carbon tetrachloride, mineral oil, cresol, with rosin and caustic soda[800]

Rosin and essential oils, with rosin soap[801]

Rosin and lubricating oil, with alkaline casein[802]

Rosin and paraffin wax, with casein and starch[803]

Rosin and paraffin wax, mineral oil, tar oil, fatty oil, montan wax, turpentine, pine oil, butyl oleate or ethyl stearate with soap or alkaline casein[804]

Rosin and paraffin wax or turpentine, with casein and soap[805]

Rosin, rubber and cymene, with caustic soda[806]

Rosin and shellac, with caustic soda and soap[807]

Rosin, turpentine, and Japan wax, with borax and soap[808]

Rubber, with bentonite[809, 810]

Rubber, with calcium oleate[811]

Rubber, with casein[812]

Rubber, with colloidal clay[813]

Rubber, with glue[814]

Rubber, with glue, albumin, casein, gum arabic, sugars, gluten, starch, dextrin or colloidal clay and soap or saponin[815]

Rubber, with glue, casein or gluten[816]

Rubber, with glue, soap and alkali casein[817]

Rubber (vulcanized), with glue, soap or casein[818]

Rubber, with morpholine soap[819]

Rubber, with oilseed cake and hulls and alkali[820]

Rubber, with soap[821]

Rubber, with soap, colloidal clay, sea moss or albuminate or gelatinate [822]

Rubber, with soap, proteins, etc.[823]

Rubber, with sodium abietate, rosinate, oleate, palmitate or stearate [824]

Rubber, with sodium cetyl sulfate [825]

Rubber (plasticized), with sodium silicate [826]

Rubber, with sodium toluene sulfonate, potassium hydroxynaphthoate, potassium sulforicinoleate, potassium sulfanilate or sodium cholate [827]

Rubber, with sulfonated mineral oil [828]

Rubber, balata or gutta-percha, benzene and sulfur, with ammonium oleate [829]

Rubber and benzene, with soap [830]

Rubber and benzene, with soap and ammonium carbonate [831]

Rubber, benzene and kerosene, with sulfonated castor oil soap [832]

Rubber chloride solution, with dextrin, casein, starch or gum arabic [833]

Rubber, chlorinated, and carbon tetrachloride, with an alkali [834]

Rubber, chlorinated,' cellulose esters or cellulose ethers and a solvent, with ammonium or potassium oleate [835]

Rubber, chlorinated, and trichlorethylene, with alkaline casein and Turkey red oil [836]

Rubber and cumar or rosin, with whiting and rosin soap, locust-bean gum, starch or dextrin [837]

Rubber and cymene, with rosin soap [838]

Rubber, fluorinated, and solvent, with sodium stearate [839]

Rubber and gasoline, with ammonium sulforicinoleate [840]

Rubber (raw or vulcanized, gutta-percha, balata or resins, with ammonium oleate [841]

Rubber and naphtha or benzol, with ammonium oleate [842]

Rubber and mineral oil, with casein and ammonia soap [843]

Rubber and oil, with metallic soap [844]

Rubber and oil, with sodium alklylnaphthalene sulfonate [845]

Rubber, reclaimed, with glue, soap, casein, gelatin or saponin [846]

Rubber, reclaimed, cumar and rosin oil, with sodium hydroxide [847]

Rubber, reclaimed, and spindle oil, with rosin soap or sulfonated castor oil [848]

Rubber and rosin, with alkali [849]

Rubber and solvent, with ammonia soap [850]

Rubber and solvent, with saponin [851]

Rubber, tar, rosin and solvent with alum and lime [852]

Rubber and turpentine, with glue and sodium carbonate [853]

Rubber and varnish with soap [854]

Sodium butadiene rubber with ammonia soap and casein[855]

Solvent (naphtha) with benzyl alcohol and butylnaphthalene sulfonic acid[856]

Solvents with carragheen kelp extract and oxalic acid[857]

Solvent, high boiling with bentonite and soap[858, 859, 860]

Solvent and phenol with tall oil and alkali[861]

Shale asphalt and montan wax with soap[862]

Shellac with protective colloids[863]

Soya protein and paraffin wax, with ammonium oleate[864]

Spermaceti, with borax and gum arabic[865]

Stearic acid, with ammonia, caustic potash, borax, triethanolamine, sulfonated oils, vegetable gums or glycol- or glyceryl stearates[866]

Stearic acid, with glue and sulfonated castor oil[867]

Stearic acid with sodium salt of naphthalene sulfonate[868]

Stearic acid, hydrogenated oils, waxes, mineral or fatty oils, with sulfonated higher fatty alcohols or hydrocarbons, e.g., lauryl alcohol sulfate[869]

Stearic acid or other higher fatty acid and paraffin oil or wax, with albumin or globulin[870]

Stearic acid, spermaceti and cetyl alcohol, with caustic soap[871]

Stearic anhydride, with deacetylated chitin[872]

Stearic anhydride, with soap[873]

Styrene, with ammonia soaps[874]

Styrene, with ammonium oleate or saponin, sulfonates or albuminoids[875, 876]

Styrene with soap or cetylpyridinium bromide[877]

Sulfur, with agar or carragheen[878]

Sulfur and asphalt, with sodium oleyl sulfate[879]

Sulfurized fatty oils, with tannic or gallic acid or tannins[880]

Sulfurized linseed oil, with tannin, gallic or tannic acid[880]

Tallow or beef fat and butter or vegetable oil, with skim milk[881]

Tallow and beeswax, with caustic potash[882]

Tallow and cresol, with soap[883]

Tar, with cumarone resin or rosin with soap[884]

Tar, with kaolin and borates, fluorides and chlorides[885]

Tar, with lime and aluminum salts[886]

Tar, with rosin soap and flour[887]

Tar, with saccharates of sodium, potassium, calcium, strontium or barium[888]

Tar, with soap and protein[889]

Tar, with sodium hydroxide[890]

Tar or asphalt, with soap and higher monohydric, aliphatic alcohol[891]

Tar or asphalt, with sodium petroleum (green) sulfonates[892]

Tar, asphalt or pitch, with metallic soap[893]

Tar or balsams, with egg yolk[894]

Tar or bitumen, with starch and soap[895]

Tar, coal, with polyvinyl chloride, soap, alkali protein or rosin soaps[896]

Tar, coal, with soap and tar[897]

Tar, coal, with soda ash and casein[898]

Tar, coal, with sodium oleate[899]

Tar, coal, with tincture of quillaja[900]

Tar, coal, and asphalt flux oil, with ammonium oleate[901]

Tar, coal or bitumen, with colloidal clay, sea-weed extract, soap, casein, starch, glue or gums[902]

Tar, coal, and mineral oils, mineral wax, naphthalene, or pitch, with alkali alginate[903]

Tar, coal, mineral, vegetable or animal oil with glue and rosin soap[904]

Tar, coal, and stearin pitch with caustic potash and casein[905]

Tar, coal or wood, with sulfonated lignin sodium salt[906]

Tar, creosote, bitumen, or petroleum with rosin soap and protein[907]

Tar and pepper oil with soap[908]

Tar or petroleum pitch with clay[909]

Tar, pitch or bitumen with rosin soap[910]

Tar, tar oil, petroleum or asphalt with brown coal[911]

Tar, wood, with algin[912]

Tar, wood, with soap and Irish moss[913]

Tar, wood or coal, or mineral oil residues with concentrated spruce sulfite liquor[914]

Terpene, maleic anhydride, polyhydric alcohol resin, with sodium hydroxide[915]

Terpineol, with sodium abeitene-sulfonate[916]

Tetrachlorethane, with laurylamine hydrochloride[917]

Tetrachlorethylene, with rosin soap and alkali casein[918]

Tetralin, with sodium oleate[919]

Thiuram and coconut oil, with casein[920]

Toluol, with sulfonated castor oil or sodium oleate, straight[921]

Toluol and hydrochloric acid, with "Emulgor A" and oleic acid[922]

Toluol and sodium chloride, with "Emulgor A" and oleic acid[922]

Triazine (melamine) resins, with soap, or sulfated fatty alcohol[923]

Trichlorethylene with alcoholic sodium oleate[924]

Trichlorethylene with bentonite and Turkey red oil[925]

Triglycerides, with lecithin or polyhydroxy alcohols partially esterified with higher fatty acid[926]

Turpentine, with gelatin or egg albumin[927]

Turpentine, with pitch rosin soap[928]

Turpentine, with soap[929]

Turpentine, oil of thyme, oil of amber and petroleum, with soap and caustic potash[930]

Turpentine and pine oil, with oxgall[931]

Turpentine and suet, with soap[932]

Varnish, with ammonium soaps[933]

Varnish, with gum tragacanth[934]

Varnish, with mahogany petroleum sulfonates[935]

Varnish, with soap and glue[936]

Varnish, with soap or sulfonated oils[937]

Varnish (Japan), with sodium hydroxide[938]

Varnish, with soybean protein and ammonia[939]

Varnish, with saponified montan wax[940]

Varnish and solvents, with sodium stearate[941]

Varnish (Japan), or asphalt with soap or alkali casein[942]

Vinyl acetate, with methyl cellulose or ethers or acetals of polyvinyl alcohol[943]

Vinyl acetate, with sulfonated castor oil[944]

Vistanex polybutene and solvents, with soap, casein or gums[945]

Vitamins (oil soluble), with fatty acid ethers or esters of polyhydroxy alcohols[946]

Vitamin A and D concentrates, with morpholine oleate, ricinoleate or linoleate[947]

Vitamin D concentrate, with polyglyceryl partial fatty acid ester, lecithin or glyceryl monolaurate[948]

Vitamin containing vegetable oils, with agar or Irish moss or egg yolk[949]

Vitamins, or irradiated ergosterol and vegetable oil, with gelatin, agar, carragheen, egg yolk, casein, gum arabic or tragacanth[950]

Wax, with cetylmethylpiperidinium methylsulfate[951]

Wax, with soap[952]

Wax, hydrocarbon, with oil-soluble petroleum sulfonic acid soap[953]

Wax, hydrocarbon, or oils, with alkylated naphthalene sulfonic acid or salt[954]

Wax or rosin and coal oil, with bentonite[955]

Wax, vegetable, with caustic potash[956]

Wool fat, with methyl cellulose[957]

Wool fat and varnish resin, with ammonia soap[958]

Wool grease, with blood albumin[959]

Wool grease, with cyclohexanol[960]

Xylene, with sodium oleate and phenol[961]

Xylene and phenol, with sodium oleate[962]

Xylene or sulfonated xylene, with Turkey red oil or soap or sulfated higher alcohol salts[963]

REFERENCES *

[1] Clarke, Pharm. J. *127,* 435 (1931)
[2] Konrad, Ger. 658,172 (1938).
[3] Gumlich, Ger. 679,587 (1939).
[4] Pickering, Kolloid-Z. *7,* 395 (1910).
[5] I. G., Brit. 267,534 (1926).
[6] Pollard, U. S. 2,206,046 (1940).
[7] Pollard, U. S. 2,206,046 (1940).
[8] Glyco Products Co., Inc., Brooklyn, N. Y. (Catalog).
[9] Von Ammag, Kolloid-Z. *6,* 235 (1910).
[10] Von Ammag, Kolloid-Z. *7,* 67 (1911).
[11] Casanovas, Bull. Soc. Ind. Mulhouse *102,* 147 (1936).
[12] Villain, U. S. 1,877,743 (1932).
[13] Montgomerie, Brit. 374,111 (1932).
[14] Lechler, Ger. 601,891 (1934).
[15] Hans Muhlen, Fr. 771,284 (1934).
[16] Lechler, Fr. 738,596 (1932).
[17] Levy, Brit. 246,907 (1924).
[18] Lewis, U. S. 1,787,418 (1930).
[19] Kirschbraun, U. S. 1,859,517 (1932).
[20] Spence, Pulp Paper Mag. Can. *22,* 608 (1924).
[21] La Trinidad, Brit. 279,026 (1926).
[22] Painter, U. S. 2,023,540 (1935).
[23] Lechler, Brit. 333,496 (1929).
[24] Hixon, Ind. & Eng. Chem. *24,* 1336 (1932).
[25] Schutte, U. S. 1,950,272 (1934).
[26] Gabriel, Brit. 322,792 (1928).
[27] Loebl, U. S. 1,960,115 (1934).
[28] Michelsen, Dan. 38,178 (1927).
[29] Taylor, U. S. 1,932,648 (1933).
[30] Shiperevich, Azerbaidzahanskoye Neft. Khoz. *10,* 36 (1929).
[31] Neitzke, Can. 323,861 (1932).
[32] Prec, Ger. 537,792 (1927).
[33] Levy, Brit. 292,251 (1927).
[34] Dutch; 14,751 (1926).
[35] Hixon, Ind. & Eng. Chem. *24,* 1336 (1932).
[36] Kirschbraun, U. S. 1,738,776 (1929).
[37] International, Brit. 400,409 (1933).
[38] Fain, Am. Perfumer *28,* 96 (1933).
[39] Kirschbraun, U. S. 1,517,075 (1924).
[40] Weiss, Mineralole *6,* 623 (1933).
[41] Browne, Australia 2185 (1931).
[42] Montgomerie, Brit. 300,831 (1927).

* U. S. refers to U. S. Patent; Ger. to German Patent; Fr. to French Patent; Brit. to British Patent; Dan. to Danish Patent; Can. to Canadian Patent; Japan. to Japanese Patent; Dutch to Dutch Patent; Swed. to Swedish Patent; Swiss to Swiss Patent.

[43] du Pont, Brit. 437,674 (1935).
[44] Limberg, Ger. 542,634 (1928).
[45] Halverson, U. S. 1,757,083 (1930).
[46] Montgomerie, Brit. 300,414 (1927).
[47] Montgomerie, Brit. 300,415 (1927).
[48] Travis, U. S. 1,757,102 (1930).
[49] Banks, U. S. 1,855,934 (1932).
[50] Parker, U. S. 1,562,564 (1925).
[51] Hay, Brit. 243,398 (1924).
[52] Neitzke, Can. 341,465 (1934).
[53] Davis, U. S. 2,216,311 (1940).
[54] Levy, Brit. 246,907 (1924).
[55] Steininger, U. S. 1,988,879 (1935).
[56] Halvorsen, Brit. 307,288 (1928).
[57] Smith, U. S. 1,926,246 (1933).
[58] Metallges., Brit. 353,702 (1929).
[59] Barth, U. S. 2,243,519 (1941).
[60] Ross, Brit. 120,961 (1917).
[61] Painter, U. S. 1,793,957 (1931).
[62] Svensson, Ger. 669,152 (1938).
[63] Levy, Brit. 292,251 (1927).
[64] I. G., Brit. 334,426 (1928).
[65] Hepburn, U. S. 1,931,072 (1934).
[66] Jones, U. S. 1,699,536 (1929).
[67] Koizumi, Japan, 130,457 (1939).
[68] Neitzke, U. S. 1,940,431 (1933).
[69] MacKay, Brit. 230,177 (1923).
[70] Kirschbraun, U. S. 1,960,112 (1934).
[71] MacKay, Brit. 233,784 (1924).
[72] Société Chimique, Ger. 587,829 (1933).
[73] Hopkins' Sci. Amer. Cyclop. Form. p. 616 (1912).
[74] MacKay, Brit. 236,641 (1924).
[75] Limburg, Ger. 536,912 (1928).
[76] Levin, U. S. 1,997,868 (1935).
[77] Montgomerie, Brit. 321,334 (1928).
[78] Fraser, U. S. 1,258,103 (1918).
[79] Fraser, U. S. 1,259,223 (1918).
[80] Zimmer, Brit. 11,331 (1915).
[81] Sansoube, Fr. 810,310 (1937).
[82] Overgard, Brit. 467,719 (1937).
[83] MacKay, Brit. 233,430 (1924).
[84] Hans Muhlen, Brit. 382,432 (1932).
[85] Kraft, Fr. 730,961 (1932).
[86] Kirschbraun, U. S. 1,506,371 (1924).
[87] Bakelite Corp. (Catalog).
[88] Mencière, J. Pharm. Chim. *15,* 52 (1917).
[89] Hopkins' Sci. Amer. Cyclop. Form. p. 527 (1912).
[90] I. G., Brit. 345,184 (1929).
[91] Artus. Farben-Chem. *9,* 405 (1939).
[92] Hopkins' Sci. Amer. Cyclop. Form. p. 387 (1912).

[93] Vishnevskaya, Schriften Z. biochem. Forsch. Nahr. Genuss (U.S.S.R.) *3*, 392 (1933).

[94] Smirnov, Vses. Nauch-Issledov, Inst. Shirov 116 (1935).

[95] Briggs, J. Phys. Chem. *18*, 34 (1912).

[96] Holmes, J. Phys. Chem. *29*, 1205 (1925).

[97] Holmes, Colloid Symp. Monograph *2*, 137 (1925).

[98] Bennett, Ind. & Eng. Chem. *22*, 1255 (1930).

[99] Whittelsey, U. S. 1,793,983 (1931).

[100] Friedman, J. Am. Chem. Soc. *53*, 2898 (1931).

[101] Tartar, J. Phys. Chem. *33*, 435 (1929).

[102] Henley's Twentieth Century Formulas p. 185 (1940).

[103] Kerasin, Ger. 630,280 (1936).

[104] Kadmer, Seifensieder Z. *58*, 663 (1931).

[105] Henley's Twentieth Century Formulas p. 205 (1940).

[106] Rasser, Kunstoffe *15*, 71 (1925).

[107] Wilcken, Brit. 405,906 (1934).

[108] Ellis, Chem. of Synthetic Resins p. 944.

[109] Hotton, Brit. 252,258 (1925).

[110] Plauson, Can. 276,480 (1927).

[111] Smith, U. S. 1,888,295 (1932).

[112] Walmsley, Brit. 350,744 (1930).

[113] Levy, Can. 263,783 (1926).

[114] Kirschbraun, U. S. 1,620,899 (1927).

[115] Groskopf, U. S. 2,104,077 (1938).

[116] McKesson, U. S. 2,074,731 (1937).

[117] Buckav, Brit. 298,842 (1928).

[118] Finley, U. S. 1,625,304 (1927).

[119] N. V. de Bat, Fr. 792,874 (1936).

[120] Kirschbraun, U. S. 1,859,517 (1932).

[121] Grader, Ger. 703,599 (1941).

[122] Vialit, Ger. 604,328 (1934).

[123] Daimler, Ger. 627,465 (1936).

[124] I. G., Brit. 433,550 (1935).

[125] I. G., Brit. 441,879 (1936).

[126] Ackerman, Ger. 546,517 (1927).

[127] Smith, U. S. 1,895,775 (1933).

[128] Kahl, Brit. 275,928 (1927).

[129] I. G., Ger. 653,958 (1937).

[130] Blott, Brit. 514,747 (1939).

[131] Colas, Brit. 320,847 (1928).

[132] Hay, Brit. 252,260 (1925).

[133] Dornig, Ger. 658,439 (1938).

[134] Bert, U. S. 2,136,667 (1938).

[135] Gabriel, U. S. 1,886,334 (1932).

[136] Salviam, Fr. 817,086 (1937).

[137] Gabriel, Brit. 441,782 (1936).

[138] McGivern, Brit. 251,098 (1925).

[139] Groskopf, Can. 372,486 (1938).

[140] Gabriel, U. S. 1,894,617 (1933).

[141] Bray, U. S. 2,080,689 (1937).

[142] Asphalt Cold Mix Ltd. Fr. *36,* 752 (1929).
[143] Vialit, Ger. 590,723 (1934).
[144] Mineral A. G., Brit. 271,177 (1926).
[145] Thompson, Brit. 263,307 (1926).
[146] Geigy, Ger. 602,165 (1934).
[147] Hay, Brit. 239,120 (1924).
[148] Wintsch, Fr. 648,917 (1928).
[149] Hay, U. S. 1,582,467 (1926).
[150] General, Fr. 664,935 (1928).
[151] J. Appl. Chem. Russ. *13,* 428–35 (1940).
[152] Solvev, J. App. Chem. (U.S.S.R.) *13,* 428 (1940).
[153] Gabriel, Brit. 329,965 (1929).
[154] Illemann, Brit. 105,202 (1916).
[155] Bennett, Brit. 291,502 (1927).
[156] Finck, Ger. 539,165 (1928).
[157] Billinghame, Brit. 255,911 (1925).
[158] Low, Brit. 221,380 (1923).
[159] Minaichev, Russ. 46,651 (1936).
[160] Buckley, U. S. 2,256,886 (1941).
[161] Ger. 556,932 (1929).
[162] Bock, U. S. 1,924,227 (1933).
[163] Woltham, U. S. 2,222,967 (1940).
[164] I. G., Brit. 366,944 (1930).
[165] I. G., Brit. 523,130.
[166] I. G., Brit. 307,938 (1928).
[167] Lechler, U. S. 1,851,104 (1932).
[168] Bock, U. S. 1,924,227 (1933).
[169] Bock, Brit. 291,748 (1938).
[170] Tschunkur, Ger. 542,646 (1930).
[171] Balandina, Bull. Acad. Sci. U.S.S.R. Ser. Chim. p. 397 (1936)
[172] I. G., Fr. 658,359 (1928).
[173] Buck, U. S. 1,898,522 (1933).
[174] Tschunkur, U. S. 1,938,731 (1933).
[175] Sebrell, U. S. 2,215,379 (1940).
[176] North, U. S. 1,509,083 (1924).
[177] Jordan, U. S. 1,859,240 (1932).
[178] North, U. S. 1,509,086 (1924).
[179] North, U. S. 1,584,126 (1926).
[180] Vander Meulen, U. S. 2,152,829 (1939).
[181] Hsi-Ching, J. Phys. Chem. *30,* 713 (1926).
[182] Fleming, Ind. & Eng. Chem. *17,* 1087 (1925).
[183] Fisher, Ind. & Eng. Chem. *19,* 1201 (1927).
[184] J. Econ. Entomol. *33,* 662 (1940).
[185] I. G., Fr. 640,783 (1927).
[186] Fox, Brit. 389,122 (1927).
[187] Dyson, Brit. 10,311 (1915).
[188] Hartzell & Moore, U. S. 1,772,511 (1930).
[189] Hunsdiecker, Brit. 428,987 (1935).
[190] Ruchow, Ind. & Eng. Chem. *28,* 1298 (1936).
[191] Martin, Trans. Faraday Soc. *37,* 26 (1941).

[192] Ruchow, Ind. & Eng. Chem. *28,* 1298 (1936).
[193] Herzog, U. S. 1,543,385 (1925).
[194] Crockett, Ind. & Eng. Chem. *9,* 967 (1917).
[195] Hubbard, Can. 309,361 (1931).
[196] Eckelmann, Brit. 201,379 (1922).
[197] Hough, Brit. 160,738 (1920).
[198] Steinle, U. S. 2,234,934 (1941).
[199] Glickman, Soap *12,* 97, 119 (1936).
[200] Robertson, Soap *14,* 99 (1938).
[201] Steinle, U. S. 2,234,934 (1941).
[202] Davis, U. S. 1,637,475 (1927).
[203] Bennett, Melliand Tex. Monthly *4,* 297 (1932).
[204] Bailey, U. S. 1,231,554 (1917).
[205] Gallsworthy, U. S. 2,071,027 (1937).
[206] Grosvenor, U. S. 1,311,964 (1919).
[207] Bridgeman, U. S. 1,943,468 (1934).
[208] Glickman, Soap *14,* 86 (1938).
[209] Goikhman, Farmatsiya *10,* 10 (1939).
[210] Strouts, U. S. 2,139,866 (1938).
[211] I. C. I., Brit. 410,503 (1934).
[212] Kieskalf, Ger. 683,232 (1939).
[213] Kieskalf, Ger. 687,387 (1940).
[214] Carothers, Brit. 468,693 (1937).
[215] du Pont, Brit. 387,340 (1933).
[216] Hofmann, Z. Biol. *63,* 395 (1914).
[217] Walker, U. S. 2,263,322 (1941).
[218] Chem. Forsch. Brit. 475,162 (1937).
[219] Law, J. Soc. Chem. Ind. *60,* 66 (1941).
[220] Raschig, U. S. 1,816,297 (1931).
[221] Bollman, Brit. 330,450 (1929).
[222] Muller, U. S. 2,111,402 (1938).
[223] Chem. Pharm. A. G., Ger. 667,500 (1938).
[224] Langwell, U. S. 1,993,706 (1935).
[225] Leatherman, U. S. 2,277,048 (1942).
[226] Freymuth, Deut. Parfum Z. *8,* 28 (1922).
[227] Hirchberg, Chem. Z. *52,* 826 (1928).
[228] McClellan, Brit. 516,195 (1939).
[229] Buckman, U. S. 2,242,106 (1941).
[230] Knigge, Z. Dout. Oel, Fett Ind. *44,* 617 (1924).
[231] Senuma, Jap. 110,729 (1935).
[232] Boyland, Lancet *II,* 1108 (1932).
[233] Berenblum, Lancet *II,* 1107 (1932).
[234] U. S. 1,709,294 (1929).
[235] Watanabe, Jap. 90,826 (1931).
[236] Hercules Powder Co., Wilmington, Del., Catalog.
[237] Hercules Powder Co., Wilmington, Del., Catalog.
[238] O'Kane, U. S. 2,041,264 (1936).
[239] Maximoff, U. S. 1,910,846 (1933).
[240] Daimler, Ger. 502,599 (1927).
[241] I. G., Brit. 312,949 (1928).

[242] I. G., Brit. 292,103 (1927).
[243] I. G., Brit. 312,201 (1927).
[244] I. G., Fr. 643,062 (1927).
[245] Petke, U. S. 2,232,470 (1941).
[246] Bollman, Ger. 511,851 (1929).
[247] Orienburger, Brit. 317,730 (1928).
[248] I. G., Brit. 339,255 (1929).
[249] Brit. Cellophane Ltd., Brit. 523,720 (1939).
[250] Holmes, J. Amer. Chem. Soc. *47,* 323 (1925).
[251] Patrick, Brit. 359,000 (1929).
[252] Bobb, Virginia Fruit *27,* 131 (1939).
[253] Tuennermann, U. S. 2,210,964 (1940).
[254] McGuffie, Brit. 469,344 (1937).
[255] I. P. D., Fr. 652,981 (1928).
[256] Gropengiesser, U. S. 1,958,820 (1934).
[257] Hilditch, Fr. 783,388 (1935).
[258] Gurwitsch, Brit. 534,223 (1941).
[259] Epstein, U. S. 2,217,309 (1940).
[260] Beckman, U. S. 1,216,052 (1917).
[261] Behrend, U. S. 1,944,962 (1934).
[262] Lowe, Brit. 525,003 (1940).
[263] Sitnin. Chem. Zentr. *1,* 3282 (1938).
[264] English, J. Econ. Entomol. *18,* 513 (1925).
[265] Pouettre, Brit. 481,392 (1938).
[266] Belknap, U. S. 1,533,158 (1925).
[267] Kirschbraun, U. S. 1,701,622 (1929).
[268] Varadhan, J. Indian Inst. Sci. *13A,* 21 (1930).
[269] Simpson, Brit. 106,197 (1916).
[270] Narayanaswamy, J. Ind. Inst. Sci. *17A,* 75 (1934).
[271] Herzog, Brit. 244,598.
[272] Darlinton, U. S. 1,689,864 (1929).
[273] Kirschbraun, U. S. 1,832,987 (1931).
[274] Knight, Can. 304,857 (1930).
[275] Baird, Brit. 349,988 (1929).
[276] Billing, Brit. 532,343 (1939).
[277] Zamarini, Tested Formulary p. 104 (1937).
[278] Biddle, U. S. 1,624,088 (1927).
[279] Pratt, U. S. 1,833,038 (1931).
[280] Societe Sep., Fr. 832,442 (1938).
[281] Vicker, Dept. Sci. Ind. Res. Rept. Food Inv. Board 1929, 24 (1930).
[282] Hessle, U. S. 1,921,158 (1933).
[283] Kirschbraun, U. S. 1,701,620 (1929).
[284] Hubmajer, Fr. 714,853 (1931).
[285] Moseley, Brit. 203,720 (1922).
[286] Bohler, Ger. 696,941 (1940).
[287] Private Communication.
[288] Colloid Chem. Labs., N. Y. C. Catalog.
[289] Dinsmore, U. S. 1,732,795 (1929).
[290] Luther, U. S. 1,864,078 (1932).
[291] I. G., Fr. 647,041 (1928).

[292] I. G., Brit. 512,703 (1939).
[293] Plauson, Brit. 156,119 (1920).
[294] Dinsmore, Brit. 297,059 (1927).
[295] I. G., Brit. 330,272 (1928).
[296] Noble, U. S. 1,831,544 (1931).
[297] Hildenbrand, U. S. 1,515,950 (1924).
[298] Teach, U. S. 1,598,664 (1926).
[299] De Ong, Can. 305,500 (1930).
[300] U. S. 1,875,466 (1932).
[301] U. S. 1,937,969 (1933).
[302] Moore, J. Am. Chem. Soc. *41,* 940 (1919).
[303] Schlaepfer, J. Chem. Soc. *113,* 522 (1918).
[304] Schlaepfer, J. Soc. Chem. Ind. *37,* 402 (1918).
[305] Spychalcki, Rocznicki, *14,* 904 (1934).
[306] Griffin, J. Am. Chem. Soc. *45,* 1648 (1923).
[307] Akker, Brit. 166,274 (1919).
[308] Grasselli Chemical Co., Brit. 464,776 (1937).
[309] Briggs, Ind. & Eng. Chem. *13,* 1008 (1921).
[310] Uranov, Byull, Ob. Opyt. Lacke. Prom. *6,* 22 (1940).
[311] Heidorf, U. S. 1,358,151 (1920).
[312] Joshi, Kolloid-Z. *34,* 197 (1924).
[313] E. I. du Pont de Nemours and Co., Wilmington, Del., Catalog.
[314] Baxter, Agr. J. Fiji *11,* 66 (1940).
[315] Dreyling, Brit. 528,069 (1939).
[316] Strauch, U. S. 2,235,507 (1941).
[317] Ruyssen, J. Pharm. Belg. *19,* 557 (1937).
[318] Stesskal, Brit. 271,120 (1926).
[319] Baker, U. S. 1,553,294 (1925).
[320] Newton, U. S. 1,791,832 (1931).
[321] Hopkins' Sci. Amer. Cyclop. Form. p. 388 (1912).
[322] Baird, Conn. Agric. Exp. Sta. Bull. *434,* 285 (1940).
[323] Flint, Trans. Ill. State Hort. Soc. *68,* 153 (1934).
[324] Robinson, Munic. Eng. Sanit. Record *108,* 24 (1941).
[325] Luther, U. S. 1,896,491 (1933).
[326] Fixentscher, Ger. 642,574 (1937).
[327] Manson, U. S. 2,030,385 (1936).
[328] Pirie, U. S. 2,136,020 (1938).
[329] Pirie, Brit. 460,578 (1937).
[330] Pott, U. S. 1,944,367 (1934).
[331] McDonnell, Ind. & Eng. Chem. *21,* 71 (1929).
[332] Volck, U. S. 1,922,607 (1933).
[333] Iyer, Proc. 15th Indian Sci. Cong. 134 (1928).
[334] Braslvaskii, Plast. Massy. Sbornik *2,* 87 (1937).
[335] Hollabaugh, U. S. 2,044,572 (1936).
[336] Hollabaugh, U. S. 2,101,066 (1937).
[337] Davies, Brit. 328,657 (1928).
[338] Whittelsey, Brit. 233,367 (1922).
[339] Davies, Brit. 328,934 (1928).
[340] Morozob, Org. Chem. Ind. (U.S.S.R.) *5,* 333 (1938).
[341] King, Brit. 499,858 (1939).

[342] Pratt, U. S. 1,870,864 (1932).
[343] Berkman, J. Phys. Chem. *39*, 527 (1935).
[344] Calais, Fr. 748,882 (1933).
[345] U. S. 1,862,322 (1932).
[346] U. S. 1,675,227 (1928).
[347] Ger. 556,932 (1929).
[348] E. I. du Pont de Nemours and Co., Wilmington, Del., Catalog.
[349] Schwarz, Amer. Dyestuff Rep. *29*, 220 (1940).
[350] Ballman, Ger. 511,851 (1929).
[351] Redlich, Fr. 643,055 (1927).
[352] Stea, Schweiz. Apoth.-Z. *73*, 618 (1935).
[353] Harris, U. S. 2,192,907 (1940).
[355] Schacht, Ger. 697,133 (1940).
[356] Progil, Fr. 729,930 (1931).
[357] M. T. P., Ger. 542,239 (1929).
[358] Auerbach, Kolloid-Z. *51*, 176 (1930).
[359] Osawa, U. S. 1,833,852 (1931).
[360] Nitardy, U. S. 1,799,804 (1931).
[361] Colbeth, U. S. 2,172,955 (1939).
[362] Duhm, Ger. 504,499 (1926).
[363] Henley's Twentieth Century Book of Formulas p. 154 (1940).
[364] Dewey, U. S. 1,737,222 (1929).
[365] Merrell & Bye, U. S. 1,862,315 (1932).
[366] Valentine, U. S. 1,804,135 (1931).
[367] Bye, Can. 303,454 (1930).
[368] Barber, Eng. & Boiler House Rev. *55*, 156 (1941).
[369] Langevin, J. Amer. Phar. Assoc. *22*, 728 (1933).
[370] Fleming, Ind. & Eng. Chem. *20*, 847 (1928).
[371] Fiero, J. Am. Pharm. Assoc. *27*, 402 (1938).
[372] Fialkov, Z. anal. Chem. *70*, 227 (1927).
[373] Tumbler, U. S. 1,969,387 (1934).
[374] Loesch, U. S. 1,759,182 (1930).
[375] Wilson, U. S. 2,154,294 (1939).
[376] Iselin, Boll. chim. farm. *67*, 255 (1928).
[377] Hopkins' Sci. Amer. Cyclop. Form. p. 55 (1912).
[378] Gershenfeld, Amer. J. Pharm. *111*, 314 (1939).
[379] Parker, Brit. 333,303 (1929).
[380] Wright, U. S. 1,449,718 (1923).
[381] Dunham, U. S. 1,432,057 (1922).
[382] Wright, U. S. 1,454,421 (1923).
[383] Stevens, Fr. 486,528 (1918).
[384] Grindrad, U. S. 1,435,464 (1922).
[385] Peters, Textile Colorist *63*, 515 (1941).
[386] Bollmann, Ger. 474,879 (1927).
[387] Gesell, U. S. 1,475,574 (1923).
[388] Sherwood, Can. 305,618 (1941).
[389] Ayres, U. S. 1,467,081 (1922).
[390] Hopkins' Sci. Amer. Cyclop. Form. p. 819 (1912).
[391] Draisbach, U. S. 2,145,344 (1939).
[392] Wagner, U. S. 1,845,370.

[393] Flatlers, Brit. 129,456 (1918).
[394] Roberg, Deut. Apoth.-Z. *54,* 416 (1939).
[395] Pharm. Zentralhalle *75,* 421 (1934).
[396] Hattori, U. S. 1,752,176 (1930).
[397] Miyake, Jap. 35,730 (1920).
[398] Pentosin, Ger. 593,395 (1934).
[399] Halz, Ger. 503,623 (1925).
[400] Iselin, Pharm. Acta. Helv. *1,* 45, 81 (1926).
[401] Draisbach, Brit. 461,535 (1937).
[402] Scoville, J. Amer. Pharm. Assoc. *17,* 119 (1928).
[403] Whatmough, U. S. 1,663,323 (1928).
[404] Kyser, J. Amer. Pharm. Assoc. *14,* 392 (1925).
[405] Buck, U. S. 1,421,125 (1922).
[406] Morris, U. S. 2,125,849 (1938).
[407] Werner, U. S. 1,445,427 (1923).
[408] Kilgore, Oil and Soap *11,* 72 (1934).
[409] Glyco Products Co., Inc., Brooklyn, N. Y., Catalog.
[410] Paessler, U. S. 1,203,905 (1916).
[411] Lenher, J. Phys. Chem. *22,* 68 (1918).
[412] Roon, Ind. & Eng. Chem. *9,* 159 (1917).
[413] Fulton, Brit. 249,912 (1924).
[414] Bobb, Virginia Fruit *26,* 74 (1938).
[415] Wondruscka, U. S. 1,480,589 (1924).
[416] Carleton, The Chemist *18,* 454 (1941).
[417] Pease, Brit. 428,317 (1935).
[418] Varadhan, J. Ind. Inst. Sci. *18A,* 49 (1935).
[419] Sachdev, Indian Soap J. *5,* 81 (1938).
[420] Cory, J. Econ. Ento. *10,* 111 (1917).
[421] Kobayasi, Jap. 129,752 (1939).
[422] Downey, Food Ind. *9,* 54 (1940).
[423] Wagner, Farben.-Ztg. *34,* 947 (1929).
[424] Morgans, Paint Manuf. *11,* 32, 44 (1941).
[425] Ferier, Brit. 450,317 (1936).
[426] Ferier, Fr. 40,532 (1930).
[427] Cate, Amer. Paint J. *22,* 58 (1938).
[428] Gliksman, Ger. 688,581 (1940).
[429] LaWall, J. Amer. Pharm. Assoc. *14,* 703 (1925).
[430] Albert, Soap, Perf., Cosmetics *12,* 498 (1939).
[431] Arkell, U. S. 1,526,039 (1925).
[432] Linehan, Aromatics *9, 22,* 62 (1928).
[433] Braunlich, U. S. 1,580,952 (1926).
[434] Plauson, Brit. 184,534 (1921).
[435] Grote, U. S. 2,079,166 (1937).
[436] Gordon, U. S. 1,619,861 (1927).
[437] Gorton, Brit. 120,836 (1918).
[438] Rohm, Can. 280,578 (1928).
[439] Bohm, Brit. 313,966 (1928).
[440] Kelley, Brit. 283,711 (1927).
[441] Odagiri, Jap. 130,081 (1939).

[442] Luck, Kunststoffe *30,* 235 (1941).

[443] Bollman, Brit. 348,783 (1929).

[444] Olsen, Dan. 36,481 (1926).

[445] Geigy, Brit. 307,000 (1927).

[446] Henley's Twentieth Century Formulas p. 424 (1940).

[447] Johnstone, Mfg. Conf. *19,* 14 (1939).

[448] Spencer, U. S. 2,125,753 (1938).

[449] Roberts, Brit. 434,109 (1935).

[450] Roberts, Brit. 434,180.

[451] Darsey, U. S. 2,208,524 (1940).

[452] Susanov, Azerbeidjanskoye Neft. Kohz. *8,* 92 (1927).

[453] Johnson, Brit. 34,294 (1919).

[454] Wood, U. S. 2,248,153 (1941).

[455] Schov, U. S. 2,220,976 (1940).

[456] McConnell, Brit. 13,794 (1915).

[457] Hopkins' Sci. Amer. Cyclop. Form. p. 541 (1912).

[458] E. I. du Pont de Nemours & Co., Wilmington, Del. (Catalog).

[459] Hopkins' Sci. Amer. Cyclop. Form. p. 542 (1912).

[460] Henley's Twentieth Century Formulas p. 436 (1940).

[461] S. A. R. L., Fr. 761,172 (1934).

[462] Navarre, Fr. 746,754 (1933).

[463] Amstellin, Dutch 24,257 (1931).

[464] I. G., Brit. 362,845 (1930).

[465] Horii, Jap. 99,266 (1933).

[466] Inagaki, Jap. 37,972 (1921).

[467] Schwarz, U. S. 1,692,389 (1928).

[468] Davey, 275,955 (1926).

[469] S. A. R. L., Fr. 761,172 (1934).

[470] Overton, U. S. 2,065,925 (1936).

[471] McCutcheon, Brit. 12,288 (1915).

[472] Woodman, Chem. News *143,* 145, 161 (1931).

[473] Gallois, Brit. 258,266 (1925).

[474] Murray, U. S. 1,970,572 (1934).

[475] Young, Can. 279,341 (1928).

[476] Hopkins' Sci. Amer. Cyclop. Form. p. 617 (1912).

[477] Conradson, Ind. & Eng. Chem. *9,* 166 (1917).

[478] Olsson, U. S. 1,517,577 (1924).

[479] Hartmann, Chem. Weekblad *20,* 59 (1923).

[480] Heitmann, U. S. 1,593,762.

[481] Yothers, J. Econ. Entomol. *18,* 545 (1925).

[482] Hendry, U. S. 2,058,788 (1936).

[483] Olsen, Dan. 36,481 (1926).

[484] Hulbert, U. S. 2,068,136 (1937).

[485] Miller, Can. 277,180 (1928).

[486] Miller, U. S. 1,605,130 (1926).

[487] Miller, Can. 277,180 (1928).

[488] Kelp-Ol, Brit. 317,713 (1928).

[489] Hamburg, Brit. 26,390 (1913).

[490] Noonan, U. S. 1,920,926 (1933).

[491] Merill, U. S. 1,739,686 (1929).

[492] Sullivan and Adams, U. S. 1,830,969 (1931).

[493] Knight, U. S. 2,124,782 (1938).

[494] Guthmann, U. S. 2,162,454 (1939).

[495] Curtin, U. S. 1,624,930 (1927).

[496] Deguide, Fr. 733,409 (1931).

[497] Pickering, Kolloid-Z. *7,* 208 (1910).

[498] U. S. 1,808,360 (1931).

[499] Williams, U. S. 2,112,799 (1938).

[500] Suit, U. S. 2,121,748 (1938).

[501] Mugisima, J. Soc. Chem. Ind. Japan *42,* 17 (1939).

[502] English, J. Econ. Entomol. *32,* 587 (1939).

[503] Schwarz, Brit. 517,612 (1940).

[504] Prutzman, U. S. 1,599,715 (1926).

[505] Sullivan, U. S. 1,830,969 (1931).

[506] U. S. 1,949,798 (1934).

[507] U. S. 1,949,799 (1934).

[508] Adams, U. S. 2,258,833 (1941).

[509] Knight, Pharm. J. *121,* 297 (1928).

[510] Schulman, Trans. Faraday Soc. *36,* 661 (1940).

[511] Spencer, U. S. 1,916,539 (1933).

[512] Langer, Brit. 156,517 (1921).

[513] English, J. Econ. Entom. *32,* 360 (1939).

[514] Schenzle, U. S. 2,091,886 (1937).

[515] Schick, Ger. 490,883 (1923).

[516] Rosenstein, Can. 267,366.

[517] Yates, U. S. 1,778,239 (1930).

[518] Yates, U. S. 1,778,240 (1930).

[519] Glyco Products Co., Inc., Brooklyn, N. Y. (Catalog).

[520] De Ong, Can. 305,502 (1930).

[521] Johansen, U. S. 1,373,661 (1921).

[522] Anderson, U. S. 2,211,250 (1940).

[523] Knight, Calif. Citrograph June, 1934.

[524] Heitmann, Brit. 232,259 (1924).

[525] Hoel, U. S. 1,875,001 (1932).

[526] Schulman, Trans. Faraday Soc. *36,* 651 (1940).

[527] Krantz, J. Amer. Pharm. Assoc. *18,* 463 (1929).

[528] Wampler, J. Econ. Entom. *32,* 57–69 (1938).

[529] Hart, Ind. & Eng. Chem. *21,* 86 (1929).

[530] Standard Oil Co., Brit. 514,262 (1939).

[531] Allum, U. S. 2,159,611 (1939).

[532] Flaxman, U. S. 2,145,239 (1939).

[533] Kurata, U. S. 1,466,022 (1922).

[534] Snell, U. S. 2,021,027 (1935).

[535] Mayer, Seifen-Z. *49,* 422 (1922).

[536] Hutton, Brit. 202,401 (1922).

[537] N. V. de B. P. M., Brit. 408,896 (1933).

[538] Steik, U. S. 2,204,326 (1940).

[539] Glyco Products Co., Inc., Brooklyn, N. Y. (Catalog).

[540] Glyco Products Co., Inc., Brooklyn, N. Y. (Catalog).

[541] Bezzenberger, U. S. 1,516,879 (1924).

[542] du Pont, Brit. 440,575 (1936).
[543] Boughton, J. Phys. Chem. *42,* 253 (1938).
[544] Merrill, U. S. 1,695,197 (1928).
[545] Jewel, U. S. 2,165,486 (1939).
[546] Serrallach, Ind. & Eng. Chem. *25,* 817 (1933).
[547] Glyco Products Co., Inc., Brooklyn, N. Y. (Catalog).
[548] Adams, U. S. 1,969,491 (1934).
[549] Young, Trans. Amer. Microscop. Soc. *55,* 260 (1936).
[550] Fizell, U. S. 1,582,257 (1926).
[551] Burak, U. S. 1,938,804 (1933).
[552] Boyce, S. Econ. Entom. *32,* 432 (1939).
[553] Burak, U. S. 1,938,804 (1933).
[554] Vidal, Brit. 228,390 (1924).
[555] Greenhalgh, Brit. 432,636 (1935).
[556] Glyco Products Co., Inc., Brooklyn, N. Y. (Catalog).
[557] Heckel, U. S. 1,902,304 (1933).
[558] Johnson, U. S. 2,242,429 (1941).
[559] Glyco Products Co., Inc., Brooklyn, N. Y. (Catalog).
[560] Alsberg, U. S. 1,545,993 (1925).
[561] Douglas, Brit. 221,466 (1923).
[562] Lindstaedt, U. S. 2,243,254 (1941).
[563] Grant, U. S. 1,877,851 (1932).
[564] Marlowe, U. S. Dept. of Agric., Bur. Entomol. Plant Quarantine E-150 (1940).
[565] Tottleman, U. S. 1,204,830 (1916).
[566] Kinney, Can. 284,807 (1928).
[567] Ravikovich, Russ. 54,135 (1938).
[568] Houghton, Brit. 325,938 (1929).
[569] Celanese, Brit. 484,858 (1938).
[570] General Aniline Corp., N. Y. C. (Catalog).
[571] Kirschner, Brit. 277,357 (1926).
[572] Adams, U. S. 1,841,940 (1932).
[573] Glyco Products Co., Inc., Brooklyn, N. Y. (Catalog).
[574] Dimmig, U. S. 1,621,483 (1927).
[575] Glyco Products Co., Inc., Brooklyn, N. Y. (Catalog).
[576] Wilson, U. S. 1,401,023 (1921).
[577] Ishida, Brit. 194,156 (1922).
[578] Glyco Products Co., Inc., Brooklyn, N. Y. (Catalog).
[579] Glyco Products Co., Inc., Brooklyn, N. Y. (Catalog).
[580] Patch, U. S. 1,919,125 (1933).
[581] Paulson, Brit. 185,779 (1921).
[582] Wood, Brit. 323,720 (1928).
[583] Marcusson, Mitt. Kgl. Material *36.*
[584] Schuler, U. S. 2,228,407 (1941).
[585] Glyco Products Co., Inc., Brooklyn, N. Y. (Catalog).
[586] Grant, U. S. 1,755,178 (1930).
[587] Richter, 282,819 (1928).
[588] Pressell, U. S. 1,771,347 (1930).
[589] Rohm, U. S. 1,751,217 (1930).
[590] Somerville, U. S. 1,883,042 (1932).

[591] Stapler, U. S. 2,254,713 (1941).
[592] Wilson, J. Amer. Leather Chem. Assoc. *22,* 559 (1927).
[593] Pchylin, Tsen.-Nauch. Issk. Inst. Kozh. Prom. *9,* 200 (1935).
[594] I. G., Ger. 524,211 (1926).
[595] Meunier, Compt. rend. *191,* 661 (1930).
[596] Herold, U. S. 1,548,315 (1925).
[597] Bruer, Brit. 235,516 (1924).
[598] Rotta, Brit. 504,273 (1939).
[599] Musher, U. S. 1,816,339 (1931).
[600] Clayton, Brit. 330,708 (1929).
[601] Bale, Fr. 713,743 (1931).
[602] Dixon, Sci. Proc. Roy. Dublin Soc. *19,* 421 (1934).
[603] Hampshire, Pharm. J. *103,* 82 (1919).
[604] Schnell, U. S. 1,668,608 (1928).
[605] Weber, J. Pharm. Chim. *25,* 24 (1937).
[606] I. G., Brit. 258,551 (1925).
[607] Kramer, U. S. 1,207,936 (1916).
[608] Muller, U. S. 1,705,490 (1929).
[609] Dunham, U. S. 1,302,486 (1919).
[610] Dunham, Brit. 148,734 (1919).
[611] Dunham, Brit. 148,587 (1919).
[612] Stockhausen, Brit. 312,799.
[613] Seifriz, J. Phys. Chem. *29,* 834 (1925).
[614] Canals, Bull. Sci. Pharmacol. *33,* 283 (1926).
[615] Hopkins' Sci. Amer. Cyclop. Form. p. 614 (1912).
[616] van der Willingen, Dutch 22,635 (1930).
[617] E. I. du Pont de Nemours & Co., Wilmington, Del. (Catalog).
[618] Harris, U. S. 2,258,552 (1941).
[619] Richards, U. S. 1,732,065 (1929).
[620] Hopkins' Sci. Amer. Cyclop. Form. p. 615 (1912).
[621] Tumanskii, Colloid J. (U.S.S.R.) *5,* 105 (1939).
[622] Lipkina, Chem. Zent. *11,* 576 (1939).
[623] Martin, Trans. Faraday Soc., *37,* 25 (1941).
[624] Kaiser, Deut. Apoth.-Ztg. *53,* 702 (1938).
[625] Kuhn, U. S. 1,457,080 (1923).
[626] Raubenheimer, Midland Druggist *52,* 312 (1918).
[627] Irwin, Brit. 324,637 (1938).
[628] Hellervd, Brit. 341,414 (1929).
[629] Heuter, Ger. 512,979 (1928).
[630] Picket, U. S. 2,097,737 (1937).
[631] Lofgren, U. S. 2,234,183 (1941).
[632] Glyco Products Co., Inc., Brooklyn, N. Y. (Catalog).
[633] Kaneke, Bull. Sericult. Jap. *7,* 1 (1934).
[634] Kuhl, Ger. 669,158 (1938).
[635] Hopkins' Sci. Amer. Cyclop. Form. p. 55 (1912).
[636] Lindmar, Ger. 482,131 (1927).
[637] Lindstaedt, U. S. 2,222,109 (1940).
[638] Private Communication.
[639] Rekord, Swed. 42,800 (1917).
[640] McKee, U. S. 1,909,879 (1933).

[641] Komatsu, Light of Manchuria *23,* 20 (1922).
[642] Schrauth, U. S. 2,086,479 (1937).
[643] K. D. P., Ger. 549,567 (1928).
[644] Faldini, U. S. 1,920,298 (1933).
[645] Hein, Ger. 479,085 (1925).
[646] Limburg, Brit. 291,393 (1927).
[647] Limburg, Dutch 23,111 (1930).
[648] Goldsbrough, Brit. 496,893 (1938).
[649] I. G., Brit. 318,070 (1928).
[650] Fotte, J. Amer. Pharm. Assoc. *27,* 336 (1938).
[651] Lafarge & Chanut, Fr. 747,562 (1933).
[652] Hadert, Gel, Leim, Klebstoffe *2,* 53 (1934).
[653] Lever, Brit. 528,397 (1940).
[654] Newton, Can. 376,083 (1938).
[655] Engelmann, U. S. 972,762 (1934).
[656] Flakes Akt., Swed. 41,624 (1926).
[657] Vahlreich, U. S. 1,975,672 (1934).
[658] Newton, U. S. 2,232,401 (1941).
[659] Kyser, J. Amer. Pharm. Assoc. *13,* 433 (1924).
[660] Haller, Melliands' Textilber. *8,* 1021 (1927).
[661] Douglas, U. S. 1,625,641 (1927).
[662] Bollman, Fr. 692,528 (1930).
[663] Yamanouchi, Jap. 42,414 (1922).
[664] Golodetz, Brit. 539,397 (1940).
[665] Henley's Twentieth Century Formulas, p. 290 (1940).
[666] Bennett, Oil & Fat Ind. *8,* 219 (1931).
[667] Neiman, Iskuss Volokno *6,* 283 (1935).
[668] Novak, U. S. 1,958,202 (1934).
[669] Bertsch, Ger. 622,640 (1935).
[670] I. G., Swiss 127,514 (1927).
[671] Bohme, Brit. 393,769 (1933).
[672] Bohme, Ger. 670,822 (1939).
[673] Cooper, Pharm. J. *117,* 371 (1926).
[674] Yngve, U. S. 1,829,177 (1931).
[675] Haggenmacher, U. S. 2,206,090 (1940).
[676] Bale, Swiss 168,722 (1934).
[677] Jantsch, Tech. Mitt. Malerei *55,* 75 (1939).
[678] Bennister, World Paper Trade Rev. *113,* 758 (1940).
[679] Limburg, Rec. Trav. Chim. *45,* 885 (1926).
[680] Fischer, J. Phys. Chem. *36,* 98 (1932).
[681] Rafton, U. S. 2,117,256 (1938).
[682] Henley's Twentieth Century Formulas, p. 630 (1940).
[683] Almy, U. S. 1,905,126 (1933).
[684] Agasote, Fr. 648,048 (1929).
[685] Miles, Can. 173,692 (1916).
[686] Griesinger, U. S. 2,238,109 (1941).
[687] Zaitzev, Leningrad O.S.N. Inz.-Tekh. *5,* 5 (1935).
[688] Kress, U. S. 2,058,085 (1936).
[689] Baker, U. S. 1,842,893 (1932).
[690] Levey, U. S. 2,043,897 (1936).

[691] Glyco Products Co., Inc., Brooklyn, N. Y. (Catalog).
[692] Holliday, U. S. 1,268,076 (1918).
[693] Chem. Marketing Co., N. Y. C. (Catalog).
[694] Redlich, Brit. 359,946 (1930).
[695] Kimura, Jap. 91,918 (1931).
[696] Halward, Fr. 836,354 (1939).
[697] Bohme, Fr. 736,920 (1932).
[698] Thompson, Brit. 338,176.
[699] Mayer, Brit. 491,229 (1938).
[700] Mayer, Brit. 466,410 (1937).
[701] Gunther, Ger. 690,835 (1940).
[702] French, U. S. 2,009,488 (1935).
[703] Neitzke, U. S. 1,940,432 (1933).
[704] Hydrierwerke, Brit. 307,472 (1928).
[705] Kern, U. S. 2,187,858 (1940).
[706] Gotte, Ger. 668,889 (1938).
[707] Kutton, U. S. 2,040,000 (1936).
[708] Edholm, Swed. 50,694 (1922).
[709] Ladoo, Chem. Met. Eng. *40,* 89 (1933).
[710] Roether, U. S. 1,414,670 (1922).
[711] Marcovitch, J. Econ. Entom. *32,* 154 (1939).
[712] Dumanskii, Zap. Vor. Sel'skok. Inst. (Rus.) *5,* 61 (1926).
[713] Miller, U. S. 1,605,130 (1926).
[714] Shagin, Chem.-Zentr. *1,* 774 (1938).
[715] Vallance, Drug & Cosmetic Ind. *49,* 455 (1941).
[716] Fiero, J. Amer. Pharm. Assoc. *28,* 102 (1939).
[717] Hopkins' Sci. Amer. Cyclop. Form., p. 614 (1912).
[718] Sandquist, Swed. 69,238 (1930).
[719] Simon, Swiss 76,547 (1918).
[720] Popish, Neft *5,* 20 (1934).
[721] Lotlermoser, Kolloid-Z. *48,* 362 (1929).
[722] West, Brit. 489,372 (1938).
[723] Lindstaedt, U. S. 2,210,420 (1940).
[724] Mori, U. S. 2,222,370 (1940).
[725] Takahashi, Jap. 42,471 (1922).
[726] U. S. 2,222,370 (1940).
[727] Thornley, U. S. 1,653,026 (1927).
[728] Adams, U. S. 2,193,216.
[729] Hunter, U. S. 1,257,355 (1918).
[730] Gabriel, U. S. 2,027,584 (1936).
[731] Hite, U. S. 1,290,992 (1919).
[732] Levy, Inf. mem. soc. ing. Peru, *35,* 177 (1934).
[733] Vidal, U. S. 1,229,681 (1917).
[734] Bakelite, Brit. 464,056 (1937).
[735] Chukhina, Farmatsiya *4,* 15 (1940).
[736] Rieman, J. Amer. Chem. Soc. *44,* 2507 (1925).
[737] Kirschbraun, Can. 245,715 (1924).
[738] Kirschbraun, U. S. 1,691,765 (1929).
[739] Deleux, Fr. 725,173 (1931).
[740] Kirschbraun, U. S. 1,878,974 (1932).

[741] Fain, U. S. 1,963,231 (1934).
[742] Reeve, U. S. 1,408,224 (1922).
[743] Reeve, U. S. 1,398,201 (1921).
[744] Thompson, Brit. 315,057 (1928).
[745] Smith, U. S. 1,989,775 (1935).
[746] I. G., Brit. 539,476 (1940).
[747] I. G., Brit. 506,596 (1939).
[748] I. G., Fr. 835,831 (1939).
[749] I. G., Ger. 506,889 (1928).
[750] Villian, Ger. 525,821 (1929).
[751] Wieger, Ger. 571,299 (1928).
[752] Cheetham, U. S. 2,279,387 (1942).
[753] Frick, Ger. 551,681 (1928).
[754] F. Myers, U. S. 2,220,685 (1940).
[755] Brit. 363,997 (1930).
[756] Cheetham, U. S. 2,272,057 (1942).
[757] du Pont, Brit. 528,069 (1940).
[758] Kenney, U. S. 2,051,409 (1936).
[759] Barron, Rubber Age *3*, 170 (1940).
[760] Kenney, U. S. 2,051,409 (1936).
[761] Kraus, Paint, Oil, Chem. Rev. *18*, 9 (1937).
[762] Tschunkur, Brit. 358,534 (1930).
[763] Rankin, U. S. 2,030,226 (1936).
[764] I. C. I., Fr. 708,399 (1930).
[765] Personal Communication.
[766] Bock, Brit. 358,534 (1930).
[767] Bock, Fr. 773,841 (1934).
[768] Rutoskii, Org. Chem. Ind. (U.S.S.R.) *7*, 441 (1940).
[769] Tisdale, U. S. 2,213,557 (1940).
[770] Neville Co., Pittsburgh, Pa. (Catalog).
[771] Redlich, Ger. 495,934 (1926).
[772] Kenney, Can. 354,904 (1935).
[773] Kenney, Can. 354,905 (1935).
[774] Hutton, Brit. 417,948 (1934).
[775] Mellanoff, U. S. 1,857,691 (1932).
[776] Catalin, Brit. 523,222 (1940).
[777] Dent, U. S. 2,069,178 (1937).
[778] Cheetham, U. S. 1,976,433 (1934).
[779] Bakelite, Brit. 461,649 (1937).
[780] Nobel, Brit. 499,995 (1939).
[781] Jaeger, Brit. 490,714 (1938).
[782] Villian, Brit. 319,804 (1928).
[783] Villian, Brit. 319,832 (1928).
[784] Schuh, U. S. 2,232,977 (1941).
[785] Finlayson, U. S. 2,224,293 (1940).
[786] Wagner, Angew. Chem. *50*, 43 (1937)
[787] Strother, U. S. 2,238,956 (1941).
[788] Fisher, Can. 394,976 (1941).
[789] Voltz, Ger. 697,489 (1940).
[790] Schodler, Ger. 507,506 (1925).

[791] DeCew, U. S. 1,370,884 (1921).

[792] DeCew, U. S. 1,958,470 (1934).

[793] Akt. Kolloid, Ger. 295,164 (1914).

[794] Gillet, Fr. 752,970 (1933).

[795] Wieger, Paper Maker & Brit. Paper Trade *82,* 33 (1931).

[796] DeCew, U. S. 1,958,470 (1934).

[797] Bazzochi, Fr. 781,729 (1935).

[798] Fues, U. S. 1,276,206 (1918).

[799] Hartmann, Fr. 712,360 (1931).

[800] Okada, Jap. 101,617 (1933).

[801] Kopplinger, Can. 285,449 (1928).

[802] Chisholm, Soap *17,* 113 (1941).

[803] Bachelder, U. S. 2,241,174 (1941).

[804] Baumheier, Brit. 385,344 (1932).

[805] Kern, Ger. 647,477 (1937).

[806] Levin, U. S. 2,261,167 (1941).

[807] Lawrence, U. S. 1,718,966 (1929).

[808] Hopkins' Sci. Amer. Cyclop. Form., p. 387 (1912).

[809] Kirschbraun, U. S. 1,929,499 (1933).

[810] Kirschbraun, U. S. 1,978,022 (1934).

[811] Newton, U. S. 1,899,243 (1933).

[812] Can. 358,798 (1935).

[813] U. S. 1,956,543 (1934).

[814] Pratt, U. S. 1,732,027 (1929).

[815] Pratt, Brit. 233,370 (1923).

[816] Trumbull, U. S. 1,668,879 (1928).

[817] Honda, Jap. 91,616 (1931).

[818] Metallges, Ger. 543,303 (1928).

[819] Dispersions Process, Inc., Brit. 539,605 (1940).

[820] Leites, Russ. 46,695.

[821] Akobzhanov, Caoutchouc & Gutta-percha *33,* 17,681, 17,713 (1936).

[822] Pratt, U. S. 1,755,890-2 (1930).

[823] Barron, Rubber Age (London) *15,* 325 (1935).

[824] Halstead, U. S. 1,932,661 (1933).

[825] Clarke, U. S. 2,033,276 (1936).

[826] Ewart, Can. 392,195 (1940).

[827] K. D. P., Brit. 351,427 (1928).

[828] Levin, Can. 330,016 (1933).

[829] Pratt, U. S. 1,755,569 (1930).

[830] Gelfer, J. Rubber Ind. (U.S.S.R.), p. 547 (1936).

[831] Shirashi, Can. 365,944 (1937).

[832] Sheppard, Ind. & Eng. Chem. *17,* 711 (1925).

[833] Zander, Ger. 691,745 (1940).

[834] I. G., Brit. 418,068 (1934).

[835] Brit. 436,044 (1935).

[836] Richards, Can. 360,946 (1936).

[837] Levin, U. S. 1,950,451-3 (1935).

[838] Levin, U. S. 2,261,167 (1941).

[839] Morris, U. S. 2,238,336 (1941).

[840] Villa, Brit. 288,431 (1927).

[841] Klein, Brit. 296,685 (1927).
[842] Dunlop, Brit. 353,524 (1930).
[843] Twiss, Brit. 439,505 (1935).
[844] Reel, U. S. 1,735,547 (1929).
[845] Dubois, Ger. 585,512 (1933).
[846] Metallges, Brit. 311,268 (1928).
[847] Richards, U. S. 1,671,316 (1928).
[848] Rose, U. S. 1,749,609 (1930).
[849] Fuchs, Austrian 109,167 (1927).
[850] Pratt, Brit. 217,612 (1922).
[851] Pratt, U. S. 1,621,468 (1927).
[852] Labourse, Fr. 44,177 (1934).
[853] Hopkins' Sci. Amer. Cyclop. Form., p. 620 (1912).
[854] Fuchs, Ger. 602,487 (1934).
[855] Vilchik, Kozh.-Obuv. Prom. *16,* 49 (1937).
[856] Pott, Ger. 633,517 (1936).
[857] Wilcken, Fr. 760,958 (1934).
[858] U. S. 1,544,588 (1925).
[859] U. S. 1,627,446 (1927).
[860] U. S. 1,675,227 (1928).
[861] Bennett, Brit. 491,960 (1938).
[862] Svensson, Swed. 86,859 (1936).
[863] Morell, U. S. 1,429,430 (1922).
[864] Kress, U. S. 2,192,919 (1940).
[865] Hopkins' Sci. Amer. Cyclop. Form., p. 387 (1912).
[866] Kalish, Drug Cosmetic Ind. *45,* 170 (1939).
[867] Howe, Brit. 460,736 (1937).
[868] Kritchevsky, U. S. 2,167,180 (1939).
[869] Procter & Gamble, Brit. 454,658 (1936).
[870] Higgins, Brit. 490,215 (1938).
[871] Deut. Hydrier, Fr. 671,063 (1929).
[872] Heckert, U. S. 2,099,363 (1937).
[873] Stud. Faser., Ger. 636,396 (1936).
[874] Naugatuck, Brit. 233,649 (1924).
[875] Ellis, Chemistry of Synthetic Resins 245.
[876] Ostromislensky, U. S. 1,676,281 (1928).
[877] Yamamoto, J. Soc. Chem. Ind. Japan *43,* 350 (1940).
[878] I. G., Brit. 411,241 (1934).
[879] Benkowitz, Ind. & Eng. Chem. *33,* 1165 (1941).
[880] I. C. I., Fr. 714,406 (1930).
[881] North, Brit. 232,916 (1924).
[882] Crawford, Brit. 170,705 (1920).
[883] Houston, U. S. 1,942,601 (1934).
[884] Teerstrass, Ger. 593,184 (1934).
[885] Vogein, Fr. 845,426 (1940).
[886] G. L. Fr. 846,066 (1940).
[887] Delvaux, Ger. 471,150 (1928).
[888] Bendixen, Brit. 346,978 (1930).
[889] T. I. C., Fr. 807,958 (1937).
[890] Barber, Fr. 683,116 (1929).

[891] Fox, Brit. 333,152 (1929).

[892] Liberthson, U. S. 1,940,807 (1933).

[893] Basset, Fr. 33,627 (1927).

[894] Henley's Twentieth Century Formulas, p. 290 (1940)

[895] Lister, Fr. 645,044 (1927).

[896] Spirk, Stavivo *20,* 334 (1939).

[897] Union, Fr. 678,294 (1929).

[898] Florsheim, Ger. 643,350 (1937).

[899] Hutzenlaub, U. S. 1,665,881 (1928).

[900] Huerre, Repert. Pharm. *35,* 129 (1923).

[901] Fair, U. S. 2,087,400 (1937).

[902] Hay, Munic. Eng. Sanit. Record *81,* 86, 117 (1928).

[903] Thornley, Brit. 219,348 (1923).

[904] Disney, Brit. 274,142 (1926).

[905] Montgomerie, Brit. 462,111 (1937).

[906] Gross, U. S. 1,840,157 (1932).

[907] Billinghame, Brit. 252,449 (1924).

[908] Ono, Jap. 36,932 (1920).

[909] Prax, Austrian, 116,390 (1929).

[910] Chadder, U. S. 2,247,722 (1941).

[911] Klein, U. S. 2,038,572 (1936).

[912] Gloess, Fr. 684,905 (1929).

[913] Fry, Brit. 469,064 (1937).

[914] Cross, Brit. 263,520 (1925).

[915] Boggs, U. S. 2,230,230 (1941).

[916] Gubelman, Ind. & Eng. Chem. *23,* 1463 (1931).

[917] Elston, U. S. 2,140,519 (1938).

[918] Ortlepp, Onderstepoort J. Vet. Sci. Animal Ind. *13,* 193 (1939).

[919] Lindner, Textilber. *4,* 581 (1923).

[920] du Pont, Brit. 528,516 (1939).

[921] Trans. Amer. Electrochem. Soc. *16,* 495 (1929).

[922] Glyco Products Co., Inc., Brooklyn, N. Y. (Catalog).

[923] Amer. Cyanamid Co., Brit. 539,288 (1940).

[924] Deckert, Seifensieder Ztg. *52,* 975 (1925).

[925] Atack, Can. 309,760 (1931).

[926] Schov, Brit. 526,753 (1940).

[927] Grill, J. Am. Pharm. Assoc. *28,* 33 (1939).

[928] Kopplinger, Can. 285,449 (1938).

[929] Denille, Belg. 374,596 (1930).

[930] Hopkins' Sci. Amer. Cyclop. Form., p. 55 (1912).

[931] Henley's Twentieth Century Formulas, p. 451 (1940).

[932] Henley's Twentieth Century Formulas, p. 449 (1940).

[933] Daimler, Ger. 517,902 (1925).

[934] Rowell, U. S. 2,090,704 (1937).

[935] Heckel, Brit. 360,948 (1930).

[936] Bratke, Ger. 524,791 (1928).

[937] Oranienburger, Fr. 682,418 (1929).

[938] Davey, Phys. Rev. *11,* 138 (1918).

[939] Shen, Chigo-Tung Univ. Rept. *3,* 52 (1936).

[940] Frick, Ger. 551,681 (1928).

[941] Houston, U. S. 2,167,300 (1939).
[942] Thomson-Houston, Brit. 212,248 (1923).
[943] Ch. Forsch, Fr. 801,034 (1936).
[944] Plauson, U. S. 2,127,135 (1938).
[945] Advance Solvents and Chem. Corp., N. Y. C. (Catalog).
[946] Kropp, Ger. 623,657 (1936).
[947] Buxton, U. S. 2,268,736 (1942).
[948] Gen. Mills, Brit. 531,224 (1939).
[949] Van den Bergh, Ger. 482,494 (1921).
[950] I. G., Brit. 425,998 (1935).
[951] Hueter, U. S. 2,054,267 (1936).
[952] Bottcher, Seifensieder-Ztg. *68*, 187 (1941).
[953] Griesinger, U. S. 2,238,109 (1941).
[954] I. G., Brit. *277,277* (1926).
[955] U. S. 1,774,665 (1930).
[956] Paindaveine, Brit. 388,241 (1933).
[957] Prescher, Brit. 486,023 (1938).
[958] I. G., Brit. 383,238 (1932).
[959] Marcovitch, J. Econ. Entomol. *32*, 154 (1939).
[960] Huc, Halle aux Cuirs, p. 289 (1927).
[961] Veikhertz, Trans. Inst. Fert. & Insect. U.S.S.R. 123,227 (1935).
[962] Weichherz, Kolloid-Z. *49*, 158 (1929).
[963] Tada, Jap. 129,709 (1939).

CHAPTER X

LIST OF DEMULSIFYING AND DEFOAMING AGENTS

Acetylated higher fatty acids are used for demulsifying petroleum.[1]

Acetylsulforicinoleic acid is used as a demulsifier.[2]

Acylated amino ether is used as a demulsifier.[3]

Ammonium sulfide is a demulsifier.[4]

Amylated aromatics are used as demulsifiers.[5]

Break the petroleum emulsion, by passing under pressure through cloth or filter earth.[6]

Calcium acetate with monohydric or dihydric alcohol is used as a defoamer.[7]

Combined magnetic and electric fields are used for demulsifying.[8]

Condensation product of sulfonated aniline and aliphatic alcohol or aldehyde acts as demulsifier.[9]

Degras is dispersed under pressure into fermentation tank to break Brewer's foam.[10]

Electrical breaking of emulsion is accomplished by passing between high tension electrodes.[11, 12, 13, 14, 15, 16, 17, 18, 19, 20]

Electrical and mechanical baffle effects are used for demulsifying petroleum.[21]

Esters of blown fatty oils are used for breaking petroleum emulsions.[22]

Ester of polybasic carboxylic acid and an acylated amino ether are used as demulsifiers.[23]

Glyceryl monoricinoleate is used for demulsifying petroleum.[24]

Gravity flow is used to break crude oil emulsions.[25]

Halogenated sulfonated fatty acid or ester is used for demulsifying petroleum.[26]

Heating with SO_2 and H_2S breaks emulsions.[27]

Heat petroleum emulsions and pass them under pressure through infusorial earth, filter cloth and fine metal screen.[28]

Heat and vacuum are used to break foam.[29]

Intermittent direct current is superimposed on the applied alternating current at intervals of several seconds for breaking petroleum emulsions.[30]

Inversion of W-O emulsions, by reagents, e.g., by oxidized hydrocarbons, often breaks emulsions.[31]

Isoamyl valerate is a defoamer.[32]

Isopropanal and tributyl phosphate are used as a defoamer.[33]

Kerosene emulsions are broken by carbon black.[34]

Laurylamine hydrochloride is a defoamer.[35]

Lignin sulfonate and propylnaphthalene sulfonic acid are demulsifiers.[36]

Lower fatty acid esters of hexyl, heptyl or octyl alcohols are foam inhibitors.[37]

Microbes and sustaining medium break emulsions.[38]

Passing between moving gears of different wettabilities is used for breaking emulsions.[39]

Passing through capillary media, e.g., cloth is used for demulsifying.[39a]

Passing through zeolites and iron sulfide and quartz breaks emulsions.[40, 40a]

Phosphatide (lecithin) is a foam reducer.[41]

Reaction product of abietine, aldehyde and sulfonating agent is used for breaking emulsions.[42]

Reaction product of blown fatty oil with aldehyde reactive agent, used for demulsifying petroleum.[43]

Reaction products of sulfonated cottonseed oil with chlorinated cyclopentane are used to break mineral oil emulsions.[44]

Sodium chloride and magnesium oxide or "Tret-o-Lite" (patented mixture of soap, sodium silicate, phenol, paraffin and water); ether and carbon bisulfide are used for breaking emulsions.[45, 46]

Sodium sulfobenzyl phthaloricinoleate is a demulsifier.[47]

Solid aliphatic alcohol and liquid aliphatic alcohol of at least 8 carbon atoms are used as a defoamer.[48]

Sugars break certain oil emulsions by dehydration at the interface.[49]

Sulfated cetyl alcohol is a demulsifier.[50]

Sulfonated fatty glyceride and calcium chloride are used in breaking emulsions.[51]

Sulfated lauryl alcohol is used for breaking emulsions.[52]

Sulfonated mixture of rosin oil and castor oil is used for demulsifying petroleum.[53]

Tar oil emulsions containing sodium phenolate are resolved on standing.[54]

Violet, ultra-violet light, X-ray, etc. are used for breaking emulsions.[55, 56, 56a]

Water insoluble basic alkyl salt of petroleum sulfonic acid is used for breaking petroleum emulsions.[57, 58]

REFERENCES

[1] De Groote, U. S. 1,812,393 (1931).
[2] De Groote, U. S. 1,812,393 (1931).
[3] De Groote, U. S. 2,231,754 (1941).
[4] Hyman, U. S. 1,860,248 (1932).
[5] De Groote, U. S. 1,780,344 (1930).
[6] Dyer, U. S. 1,242,783 (1917).
[7] Clapsdale, U. S. 1,899,610 (1933).
[8] U. S. 1,949,660 (1934).
[9] Wayne, U. S. 1,937,259 (1933).
[10] Auclair, Fr. 845,543 (1940).
[11] Lawrason, U. S. 1,942,480 (1934).
[12] Worthington, U. S. 1,783,595 (1930).
[13] Seibert, U. S. 1,290,369 (1919).
[14] McKibben, U. S. 1,299,589 (1919).
[15] Roberts, U. S. 1,959,385 (1934).
[16] Alden, U. S. 1,394,462 (1921).
[17] Morrell, U. S. 1,827,276 and 1,827,714 (1931).
[18] Eddy, U. S. 1,796,750 (1931).
[19] Gage, U. S. 1,754,009 (1930).
[20] Fisher, U. S. 1,838,379 (1931).
[21] Fisher, U. S. 2,108,258 (1940).
[22] Colbeth, U. S. 2,122,976 (1938).
[23] De Groote, U. S. 2,231,755 (1941).
[24] Powell, U. S. 2,175,699 (1939).
[25] Burch, U. S. 2,203,718.
[26] De Groote, U. S. 1,908,130 (1933).
[27] Hyman, U. S. 1,800,887 (1931).
[28] Dyer, U. S. re. 15,871 (1924).
[29] McCorguodale, U. S. 2,231,544 (1941).
[30] Deutsch, Ger. 688,135 (1940).
[31] Hyman, U. S. 1,811,177 (1931).
[32] Fiske, J. Biol. Chem. *35*, 411 (1918).
[33] Brodersen, U. S. 2,200,485 (1940).
[34] Schlaepfer, J. Chem. Soc. *113*, 522 (1918)
[35] Padgett, Ind. & Eng. Chem. *32*, 487 (1940)
[36] De Groote, U. S. 1,780,343 (1930).
[37] Piker, U. S. 2,161,747 (1939).
[38] Beckman, U. S. 1,753,641 (1930).
[39] U. S. 1,932,093 (1933).
[39a] Dyer, U. S. 1,242,784 (1917).
[40] Brown, U. S. 1,911,797 (1933).
[40a] Meinzer, U. S. 1,911,839–40 (1933).
[41] Fromm, U. S. 2,097,121 (1937).
[42] De Groote, U. S. 1,961,963 (1934).
[43] Colbeth, U. S. 2,058,570 (1936).
[44] Lerch, U. S. 1,890,789 (1932).
[45] Raymond, Chemist Analyst *4*, 86 (1940).

[46] Sherrick, Ind. & Eng. Chem. *12,* 138 (1920).
[47] De Groote, U. S. 1,954,585 (1934).
[48] Steibelt, U. S. 2,085,709 (1937).
[49] Young, Trans. Am. Microscop. Soc. *55,* 260, (1936)
[50] De Groote, U. S. 1,938,322 (1933).
[51] Herbsman, U. S. 1,959,824 (1934).
[52] De Groote, U. S. 1,938,323 (1933).
[53] Kaplan, U. S. 1,902,129 (1933).
[54] Morgan, Ind. & Eng. Chem. *17,* 697 (1925).
[55] Herbsman, Brit. 356,926 (1930).
[56] Herbsman, U. S. 1,783,471 (1930).
[56a] Herbsman, Ger. 592,877 (1934).
[57] De Groote, U. S. 2,231,752 (1941).
[58] De Groote, U. S. 2,231,753 (1941).

PART II

EMULSIFYING AGENTS
AND
EMULSIONS IN INDUSTRY

A Symposium

CHAPTER XI

PAPERS ON EMULSIFYING AGENTS

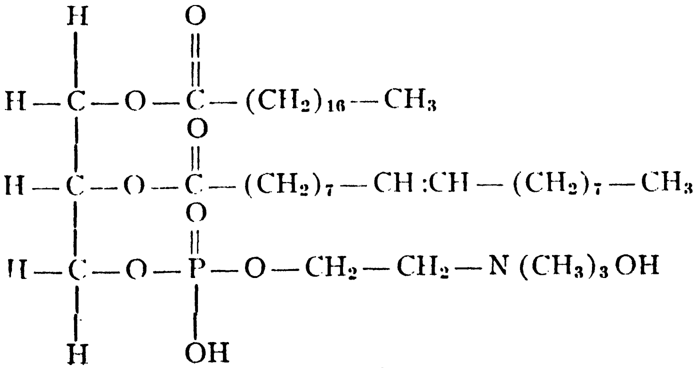
LECITHIN AS AN EMULSIFYING AGENT

HAROLD CROOKS
Chief Chemist, American Lecithin Company

LECITHIN is found widely distributed in the animal and vegetable kingdoms and is an essential constituent of the living cell. Substantial amounts are found in the brain, liver, muscles, cerebrospinal fluid, legumes, milk, eggs and fats.

Commercial vegetable lecithin is obtained chiefly from soybeans, the latter containing an average of from 1.5 to 3.0% of phosphatides, chiefly lecithin and cephalin. Good-grade commercial soybean lecithins contain approximately 65% of phosphatides in association with soya oil, the latter acting as a carrier and preservative for the phosphatides. Highly purified phosphatides oxidize and absorb moisture rapidly.

The structural formula of lecithin is generally accepted to be as follows:



$$\begin{array}{ccccccl}
 & & H & & O & & \\
 & & | & & \| & & \\
H & - & C & -O- & C & - & (CH_2)_{16}-CH_3 \\
 & & | & & O & & \\
 & & | & & \| & & \\
H & - & C & -O- & C & - & (CH_2)_7-CH:CH-(CH_2)_7-CH_3 \\
 & & | & & O & & \\
 & & | & & \| & & \\
H & - & C & -O- & P & - & O-CH_2-CH_2-N\,(CH_3)_3OH \\
 & & | & & | & & \\
 & & H & & OH & &
\end{array}$$

Lecithin forms double salts with mercuric chloride, platinic chloride and cadmium chloride. It adds bromine and iodine. When hydrolyzed it yields palmitic, oleic or stearic acids, choline, free glycerol and phosphoric acid, and glycerylphosphoric acid.

Lecithin is soluble in ether, benzol, chloroform, carbon tetrachloride, carbon disulfide, fatty oils, mineral oils, etc. It is practically insoluble in acetone, methyl- and ethyl-acetates. Lecithin is readily saponified by strong alkalies. It is a hydrophilic colloid and takes up water readily to form excellent emulsions.

When a colloid mill is not available, lecithin emulsions are best prepared by adding to the lecithin an equal weight of cold water and stirring until the water is taken up. The balance of the water is added gradually, with stirring. Heating facilitates hydration of the lecithin. High temperatures are to be avoided.

Lecithin forms monomolecular films on water, due to the presence of the hydrophobic and hydrophilic groups in the structure. It forms emulsions of the oil-in-water type. Lecithin possesses the property of lowering the surface tension of aqueous solutions, fats, and oils, and also reduces the interfacial tension between fats, oils and water.

Cephalin is found associated with lecithin. The structure of cephalin is identical with that of lecithin except that it has an amino-ethyl-alcohol group in place of choline. The fatty acids present in the structure are linoleic, stearic, oleic and arachidonic.

Cephalin is soluble in petroleum ether, carbon tetrachloride, benzene, chloroform, ethyl ether containing 1% of moisture, hot acetic acid and hot ethyl acetate. It is insoluble in acetone, alcohol and anhydrous ether.

Like purified lecithin, purified cephalin is very hygroscopic and oxidizes readily. It forms double salts with cadmium chloride and platinic chloride.

When hydrolyzed, cephalin yields fatty acids, glycerophosphoric acid and colamine.

Cephalin forms emulsions of the water-in-oil type.

Lecithin is finding ever-increasing use in many and varied fields. It is used in refined edible oils as an antioxidant, to increase the creaming quality of shortenings, in the chocolate industry, in mineral lubricants, textiles, gasoline, margarine, soaps, cosmetics, lard, paints, bakery goods, ice-cream, leather, asphalt emulsions, medicine, etc.

In ice-cream lecithin acts as an emulsifying agent of the butter fat, producing a more complete colloidal emulsion in the mix prior to freezing. This, in turn, facilitates the incorporation of smaller air bubbles or the structure of finer air cells in the body of the frozen finished product.[1] According to one method about 0.10% lecithin is added to both the fat and the aqueous phases.

In the baking industry lecithin aids in the proper mixing and development of doughs through its emulsifying action, as shown by mixogram tests.[2] It assists in the production of more uniform and more evenly textured bread, thus insuring against unduly rapid staling. It forms with the gluten a lecithin-protein complex which appears to possess better water-retaining properties and greater elasticity, especially with short-gluten flours, than does the straight gluten.

The following is quoted from Whymper's paper[3] on the use of lecithin in bread:

"The addition of lecithin causes a more complete, rapid, and extended covering of the wet dough-components by refined shortenings which can be turned to the advantage of the baker either by cutting the amount of shortening used by some 20% or by enhancing the shortening value of any amount of shortening that a formula calls for by about one-fifth.

"Lecithin brings about the formation of oil-in-water emulsions between some of the added and naturally present oils and fats and some of the "free" water of the dough during mixing, which largely accounts for the invariably drier-feeling and drier-operating lecithin doughs and for the ability of the lecithin doughs to absorb some 2% more water than can non-lecithin doughs, of the same formula otherwise, without causing dough-stickiness."

These observations on the non-stickiness of lecithinated doughs have been confirmed many times in the laboratory.

Non-lecithinated doughs are kneaded with difficulty, while the same dough after lecithinating is easily worked, forming a compact mass. The lecithin is added to the shortening in amounts of from 0.20% to 0.25% based on the flour-weight, or, if preferred, a lecithinated flour may be used.

The addition of lecithin to soaps results in decided improvements, giving greater lathering properties, more efficient cleansing action, and the property of imparting to the skin a velvety feeling.

Lecithin is readily incorporated into liquid soaps by adding the desired percentage to a small volume of the finished product, heating if necessary to facilitate solution of the lecithin, adding this lecithinated portion to the balance of the soap and filtering as usual. As little as 1.0% of lecithin will be found effective.

Lecithinated liquid coconut oil soaps have been kept in metal containers for years, remaining crystal-clear throughout each year without the formation of sediment or turbidity.

When lecithin is incorporated in shaving creams greater coverage is obtained without the drying-out effect common to many shaving creams. In addition the skin feels softer than with a non-lecithinated shave cream, possessing the velvety feel mentioned above. The lecithin is readily incorporated by melting with the fatty acids or oils used in the formula. One per cent will be found effective. It should be borne in mind that saponified lecithin does not possess the desirable properties of natural lecithin. Therefore when preparing shaving creams in which saponification plays a part, the lecithin should be incorporated after saponification is complete.

In this country and Europe lecithin is used extensively in the manufacture of margarine.[4] Texture and spreading properties are improved and, in particular, lecithin reduces spattering and sticking of milk solids to the pan during frying. As little as 0.10% of lecithin will be found effective, reducing the interfacial tension between the fat and aqueous phases.

The addition of from 0.10 to 2.0% of lecithin to butter improves the color and accentuates the butter flavor.

The use of lecithin in cocoa powder has been patented.[5]

When mixed with milk or water the cocoa particles are held in suspension, instead of separating as a sediment on the bottom, and the cocoa butter is held in solution, instead of separating as oil drops on the surface.

In the paint industry lecithin facilitates the wetting and dispersion of pigments in oils, renders paint films more elastic and prevents cracking.[6] It may be added to the vehicle in the pebble mill and in many instances permits increased pigment concentration without stiffening. For most purposes 1.0% of lecithin based on the weight of pigment may be used.

Lecithin is stated to produce a superior type of chewing gum, increasing smoothness and decreasing tackiness and cohesiveness.[7] From 1.5 to 2.0% of lecithin is used.

In the textile industry lecithin finds use as a wetting and softening agent, effecting more even and thorough dyeing, and imparting superior brilliancy of color and a softer feel to the material.[8] Dilute water emulsions containing 0.30% of lecithin can be used in finishing textiles to impart the feeling of softness and smoothness. It can be added to fatty or mineral oils to improve the spreading of the oils and to intensify the lubricating effects.

Lecithin is used in certain cosmetic preparations, promoting finer emulsification and greater spreading. The addition of 1.0% to creams will be found to impart beneficial properties. To incorporate the lecithin, it is simply melted with the fats or waxes used in the formula and the customary procedure then followed. Creams prepared with lecithin to which have been added 0.05% of Aseptoform P have been kept at room temperature for over two years without the development of mold. During the two-year period the jar covers were frequently removed.

Lecithin is used in plastic compositions, being recommended for sound records, vulcanized rubber,[9] linoleum, etc. It is claimed that lecithin reduces foaming in latex and decreases the rate of aging in linoleum.

When incorporated in wax polishes of the paste type lecithin produces greater area coverage and promotes a superior and longer-lasting gloss. The use of 1.0% of lecithin is advocated. It is melted along with the waxes used in the formula. The same results are obtained when lecithin is incorporated in shoe polishes of the paste type. In addition, the lecithin prevents drying-out of the polish in the container, a common occurrence when the cover is not put back on tightly. Leading brands of shoe polishes of the paste type have been lecithinated and, after lecithinating, have been kept loosely covered for months without drying of the paste. Leather polished with a lecithinated shoe paste offers greater resistance to water than a non-lecithinated shoe paste. Undoubtedly the lecithin facilitates penetration into the leather of the waxes contained in the polish.

In the leather industry lecithin renders the finished leather more pliable and facilitates the penetration of oils and fats into the hide. It is of special value in fat-liquoring and may be used alone in the form of a 10% water emulsion or may be used in conjunction with other fatty materials. Preparation of emulsions may be facilitated by adding a trace of alkali. Lecithin is used in tanning preparations, greases, softening oils and leather dressings.[10, 11, 12, 13, 14]

Lecithin is used as an emulsifying agent for asphalt and tar emulsions. When added to wood-preserving oils, lecithin increases the penetration of the oils.[15] The addition of 0.25 to 2.0% is recommended.

The use of lecithin in insecticide preparations has been patented. When added to contact sprays it is claimed that the addition of the lecithin results in better dispersion of the phases and greater adhesion of the spray.[16]

Oil-free phosphatides are used in many therapeutic preparations for their medicinal value, emulsifying and surface-tension-lowering properties.[17, 18] Their use is indicated in liver oil emulsions, tonics, salves, ointments, etc.

Lecithin is also used in the fixation of flavoring agents. Its use as a fixative for the volatile constituents of coffee has been patented. It is used in coffee infusions in combination with bromides. Such a combination is stated to reduce the injurious effects of caffeine.

In the electroplating field lecithin is stated to result in finer, denser and more uniform coatings. The use of 0.01% is advocated.

Used in inks lecithin promotes superior pigment dispersion and suspension and retards settling. It is a valuable addition to all colors in varnish and counteracts sagging in architectural enamels.

Lecithin is used extensively in the chocolate field for its dispersing action and its lowering of interfacial tension, resulting in a more uniform mix of the ingredients. Generally about 4 oz. are used for 100 lb. of chocolate, being added after refining. The addition of 1.0% of lecithin has a marked effect on the reduction of the interfacial tension between cocoa butter and water.

In addition to the above uses lecithin is also used in adhesives, candy, peanut butter, prepared milk products, gelatin desserts, soups, beverages, cheese, sauces, etc.

REFERENCES

[1] B. I. Masurovsky, *Ice Cream Trade J.*, April 1944.

[2] Robert Whymper, *Bakers' Helper,* June 1944.

[3] Robert Whymper, *Bakers' Helper,* July 1944.

[4] James W. Conway, and Armand May, U. S. Patent 1,965,490 (1934).

[5] U. S. Patent 1,660,541 (1928).

[6] New York Paint and Varnish Production Club, *Paint, Oil, Chem. Rev.*, 97 (23), 81 (1935).

[7] Herbert W. Conner, U. S. Patent 2,197,719 (1940).

[8] Hermann Bollman and Dr. Bruno Rewald, British Patent 353,873 (1931).

[9] Werner Esch, *Gummi-Ztg.*, **48,** 899 (1934).

[10] Hermann Bollman and Dr. Bruno Rewald, French Patent 647,456 (1928).

[11] Hermann Bollman, German Patent 516,188 (1931).

[12] Hermann Bollman, German Patent 517,354 (1931).

[13] German Patent 522,041 (1931).

[14] Hermann Bollman, and Dr. Bruno Rewald, German Patent 516,189 (1931).

[15] Robert White, Jr., and Joseph A. Vaughan, U. S. Patents 2,054,399 and 2,054,400 (1936).

[16] Euclid W. Bousquet, U. S. Patent 2,006,227 (1935).

[17] George William Johnson, British Patent 505,983 (1939).

[18] Josef Augustin, *Seifensieder-Ztg.*, **62,** 174 (1935).

PECTIN AS AN EMULSIFIER

W. •E. BAIER
California Fruit Growers' Exchange

PECTIN is most economically used in emulsions containing fairly large percentages of oil, 20 to 80% by volume, but emulsions of almost any composition may be prepared. Each oil which is to be emulsified, either within or outside this range of percentages, presents an individual problem.

In most cases emulsification with pectin is best accomplished by the Continental process, which consists first of mechanically agitating the oil or part of the oil and introducing the pectin. After the pectin is thoroughly suspended and distributed in the oil the water phase is added in one portion and the agitation continued for several minutes until the emulsion is formed, although not necessarily finished. The agitation is now stopped for 2 or 3 minutes to allow the pectin to hydrate or swell, after which another stirring period will produce a smooth emulsion. Additional quantities of oil, within limits, may now be stirred into this base emulsion. It is of extreme importance in the preparation of emulsions containing more than 50% of oil to withhold some of the oil until after the base emulsion has been formed.

A word should be said about equipment used in emulsification. This varies greatly in size and design. It is important in making pectin emulsions by the above procedure that the agitator should effectively stir the bottom of the vessel so that the pectin will not settle from the oil before or during the addition of the water. If settling does occur, there is a tendency for the pectin particles to lump. Furthermore, the design should be such that the emulsion may be drained completely from the vessel before the next batch is started. For use where these conditions may not be fulfilled, the English process, described later, is recommended.

The material of which the equipment is made is a very important consideration. Even though an emulsion may not be considered as corrosive, the material in contact with emulsions may sometimes cause serious trouble. Copper should be particularly guarded against. The detrimental effects of copper in the dairy industries are widely recognized. Copper and other heavy metals may injure the color of the emulsions, cause oxidation or rancidity development in the oils, and cause coagulation of the emulsifier, ultimately resulting in decreased stability. The stainless irons and steels, Monel metal, and glass-enameled equipment are recommended and in some cases also aluminum, heavily tinned iron or tinned copper.

The size of the batch should be proportional to the size of the equipment, and the design of the equipment should be such that little or no air is stirred into the emulsion. Likewise, in packaging, little or no air space should be tolerated. Air in the final emulsion package allows movement or vibration of the contents during shipment which may cause breaking; it helps oxidation of the oil; and it exposes the product to danger of contamination with yeasts and mold spores carried in the air.

Pectin produces "fine-grained" emulsions as compared with most other gums commonly used for emulsification. High-speed mechanical agitation enhances this characteristic and the fine oil droplets once formed in a pectin emulsion remain. For this reason pectin emulsions respond well to homogenization if exceedingly small particle size is desired. A Gaulin homogenizer or any good dairy viscolizer will prove effective on emulsions containing up to 70% oil. If it is desired to decrease viscosity and at the same time retain stability, a two-stage homogenizer valve, operated at pressures of 3500 and 900 lb. per square inch on the first and second stages respectively, will be found very satisfactory.

If the procedure as discussed above is carefully followed, successful results will be obtained. When an oil for which no emulsion formulas are available is encountered, select a formula for a similar oil and make a small laboratory batch. By observing the appearance of these trial batches and referring to the following table, it should be possible to work out quickly a suitable formula for the oil in question and to calculate the amounts needed for the larger-sized commercial batches.

SUGGESTIONS FOR IMPROVING PECTIN EMULSIONS

Fault to be corrected	*Correction*
Creaming of the emulsion, leaving an aqueous layer at bottom of vessel	Use of more pectin
Oil separation without creaming	Use of less pectin or less oil
Emulsion too thick	Use of less pectin, homogenization with two-stage valve

It will be seen from the material in the table that, unlike some other emulsifiers, less pectin is required in emulsions high in oil content than in those carrying less oil. In other words, it should be emphasized that the pectin requirement of an emulsion is governed by the water content; the less water or aqueous material present, the smaller is the amount of pectin needed.

It should be mentioned that pectin is not compatible with appreciable quantities of alkalis. Pectin emulsions are usually faintly acid, in which condition they are stable. More than a few per cent of glycerol or alcohol should be avoided in pectin emulsions because these substances tend to precipitate pectin and may gel the emulsion.

PECTIN EMULSIONS AND OINTMENTS *

KARL J. GOLDNER
Associate Professor of Pharmacy, School of Pharmacy, University of Tennessee

FROM laboratory experience, certain generalizations regarding the use of pectin can be made. In some respects pectin behaves in the same manner as acacia, but in many respects it does not. Like acacia, it may be used in both the Continental and English methods of producing emulsions. In general, the Continental method is more satisfactory. When used in the English method, the pectin should first be protected from clumping by the use of sugar, glycerin or alcohol before the addition of water. In the Continental method, the oil serves this purpose.

---

* *J. Am. Pharm. Assoc.,* 3, 324 (1942).

The primary emulsion should contain not more than 50% of oil, preferably less. The primary emulsions may be diluted with water and, to a considerable extent, with oil. One gram of pectin will replace approximately 12.5 g. of acacia and will make 100 cc. of finished emulsion. The ratio of pectin to water in the primary emulsion is best at 1:25.

Homogenization reduces the size of the oil particles but will not produce a permanent emulsion where such could not be produced with mortar and pestle alone. In other words, if the proportion of ingredients and the procedure are correct, an emulsion can be prepared with mortar and pestle. Homogenization of this emulsion will result in finer particles, and there will be less tendency for creaming to occur. If the proportion of ingredients or the procedure is not correct, an emulsion cannot be produced with mortar and pestle, nor will homogenization of such a mixture result in the formation of a permanent emulsion.

Unless adequate time is allowed for hydration of pectin to take place, stable emulsions cannot be prepared. For this reason, a standing period of at least 10 minutes is specified in the directions.

These observations are generally applicable. However it must be remembered that each oil to be emulsified presents a separate problem that can be solved only by experimentation. With acacia as the emulsifying agent, oil of apricot kernels and cod-liver oil are easily emulsified; while mineral oil is emulsified with more difficulty. With pectin, oil of apricot kernels is easily emulsified, mineral oil with more difficulty, and cod-liver oil with much more difficulty. We are speaking now, of course, of preparing emulsions to contain 50% oil, such as the official products.

Mineral Oil Emulsion

An emulsion of mineral oil is prepared according to the following formula and directions.

Liquid Petrolatum	50 cc.
Pectin *	1 g.
Syrup	10 cc.
Vanillin	0.004 g.
Alcohol	6 cc.
Distilled Water	34 cc.

Rub the pectin with 25 cc. of mineral oil, add 25 cc. of distilled water all at once and triturate until emulsification begins. Allow to stand at least 10 minutes and then triturate until a thick, creamy emulsion is formed. Add slowly, with stirring, the remainder of the mineral oil, the syrup, the remainder of the distilled water and the alcohol, in which the vanillin has been dissolved.

Cod-Liver Oil Emulsion

In the case of cod-liver oil, a better procedure is to dilute the primary emulsion with water and syrup before the addition of the second portion of oil. The formula and directions follow.

Cod-Liver Oil	50 cc.
Pectin	1 g.
Syrup	10 cc.
Methyl Salicylate	0.4 cc.
Distilled Water	40 cc.

Rub the pectin with 25 cc. of cod-liver oil, add 25 cc. of distilled water all at once and triturate until emulsification begins. Allow to stand at least 10 minutes and then triturate until a thick, creamy emulsion is formed. Add slowly, with stirring, the methyl salicylate, the syrup, the remainder of the distilled water and, lastly, the remainder of the cod-liver oil.

This emulsion shows no signs of creaming or cracking for three weeks. After this time, a small amount of oil comes to the top. Upon shaking, the homogeneity of the preparation is restored. Samples prepared with mortar and pestle or with a

---

* Throughout this paper, the term "pectin" refers to Pectin, N. F. VII. There are many commercial pectins available on the market which will not function in the formulas given here.

mechanical mixer, whether homogenized or not, all behave in the same manner.

Where a mechanical mixer is used, it is important that the agitator be an efficient one to keep the pectin completely dispersed throughout the oil before and during the addition of water; otherwise, a few particles of undissolved pectin may remain in the emulsion. These particles would tend to clog a homogenizer and make it very difficult to run the emulsion through.

Ointments

Because of the well-known healing properties of pectin pastes,[1, 2] Dr. Arthur E. Goldfarb of the College of Medicine, New York University, suggested the incorporation of various medicaments used in dermatological practice into pectin paste. However, pectin paste, unless carefully protected from access to air, will dry out in a couple of hours to form a film closely resembling a collodion film. Therefore, wool fat and white petrolatum are added to overcome this undesirable property. Upon experimentation, the following typical formula was evolved.

Boric Acid	5 g.
Glycerin	8 g.
Pectin	3 g.
Wool Fat	7 g.
White Petrolatum	25 g.
Ringer's Solution	52 g.

Triturate the boric acid and pectin with the wool fat and white petrolatum in a warm mortar. Mix the glycerin and Ringer's solution, heat to boiling, and add all at once to the fatty mixture. Stir the mixture until cool.

The following substances, in 5% concentration, can be incorporated to produce satisfactory ointments: boric acid, coal tar, juniper tar, precipitated sulfur, and ammoniated mercury. Ichthammol is used in 10% concentration. In the case of juniper tar and ichthammol, it is necessary to increase the pectin content to 4% to produce a preparation which is not too fluid.

Sulfanilamide and sulfathiazole preparations must be protected from mold by the addition of 0.2% of benzoic acid.

Because of the trace of iron contained in pectin, it is incompatible with tannic acid and salicylic acid; preparations containing tannic acid become black, and preparations of salicylic acid, purple. The addition of sodium citrate does not prevent the blackening.

Zinc oxide produces a very granular preparation. Alkalies may not be used with pectin, as pectin pastes lose their consistency above *p*H 4.5. Work is being done on the use of the newly developed sodium pectate for preparations where the *p*H is higher.

The time of the addition of the medicinal substance will depend upon its characteristics. Substances which are volatilized or injured by heat should be incorporated into the finished, cool ointment base. Substances which are quickly and completely soluble in hot water but which crystallize upon cooling of the ointment should likewise be incorporated, in the form of a fine powder, into the cool base. Most substances can be mixed with the pectin and are then easily dispersed.

REFERENCES

[1] B. Fantus and H. A. Dyniewicz, *J. Am. Pharm. Assoc.*, **28**, 548 (1939).
[2] M. L. Weston, *Am. J. Nursing*, **40**, 388 (1940).

POLYHYDRIC ALCOHOL COMPOUNDS

H. BENNETT

COMMERCIAL production of partial * glyceryl esters has been increasing steadily in volume. These are used principally because of their emulsifying and penetrating (surface-active) properties. They are referred to technically as non-ionic surface-active agents.

*** By partial glyceryl ester is meant a mono- or diglyceryl ester of a higher fatty acid, e.g., glyceryl monostearate.**

Non-ionic surface-active agents, as their name implies, are not ionizable and owe their effectiveness to a proper balance between certain hydrophilic (polar) and lipophilic (non-polar) groups in their molecules. The hydrophilic character is usually obtained by the presence of a certain minimum of accumulated polar groups, such as free hydroxyl groups.

PROPERTIES OF SOME NON-DISPERSIBLE NON-IONIC SURFACE-ACTIVE AGENTS

Compound	*Form*	*Melting Point °C.*	*Miscibility* with*				
			Ethanol	*Acetone*	*Toluene*	*Naphtha*	*Mineral Oil*
Glyceryl							
Monolaurate	Semi-Solid	22–23	M	M	M	M	M
Monooleate	Semi-Liquid	38	M	M	PM	PM	PM
Monoricinoleate	Liquid	.....	M	M	PM	I	I
Monostearate	Solid	55–57	MH	MHX	MH	MH	MH

* M: miscible; P: partly; X: in limited proportions; I: immiscible; H: hot. Miscibility in the case of solids refers to the melted material.

The stability of non-ionic surface-active agents toward salt solutions, hard water, earth alkali or heavy metal salt solutions is usually far greater than that of cationic or anionic agents of a similar degree of water solubility. Some of them are not affected, or only little affected, by limited contact with strong acids or alkalis. They are neutral, but may be adjusted to give an alkaline or acidic reaction without necessarily losing their usefulness. They may be used in conjunction with either the cationic or anionic surface-active agents, and such combinations usually have greater effectiveness than either of the ingredients alone. For instance, blends of polyhydric alcohol esters with soaps are well-known as effective emulsifiers.

The non-ionic surface-active agents are superior to the anionic and cationic agents in their range of compatibility with solvents and chemicals. Their effectiveness may be further improved by the addition of certain solvents, such as alcohols, glycols or glycol-ethers, terpene alcohols or fatty acids. Their adsorption by wool and possibly by other fibers is less than that of anionic or cationic compounds. They usually will not react with weak organic acids or bases used in conjunction with them, such as certain dyes or pharmaceuticals.

The non-ionic surface-active agents may be roughly divided into three classes, according to their behavior with water. There are those that do not, or only poorly, disperse in water, but may have the property of imbibing a quantity of it. We shall refer to them as non-dispersible. The second group will disperse when stirred or shaken with water. Some of the compounds in this group are able to absorb considerable quantities of water without turning cloudy. We shall call these agents dispersible. The last group is water-soluble, the solutions formed being clear, or opalescent like those of soap.

There are no distinct boundaries between these groups, and compounds of each type may be obtained by various combinations of chemicals. Small admixtures of alcoholic solvents or fatty acids can shift their solubility properties considerably; sometimes a material will dissolve clearly in high concentration, but yield a milky dispersion on greater dilution; sometimes the presence of electrolytes will diminish the water solubility of these surface-active agents.

The non-ionic surface-active agents of the non-dispersible type have already found numerous uses. Although they resemble oils greatly, they have a much lower surface tension and will effectively lower the surface tension of oils in which they are dissolved. Some of them have been found to form water-in-oil emulsions and help to stabilize them, such as in shortenings or in margarine, and to improve the baking qualities of certain types of pastry. Some have a distinct wetting effect upon pigments in oil or solvent media, facilitating grinding, dispersion or suspension.

All of them act as strong assistant emulsifiers and improve the action of small amounts of soap, fatty alcohol sulfates, aryl sulfonates, and similar compounds.

They are often of value as lubricants, plasticizers and softeners; they serve as mutual solvents for polar and non-polar compounds like soap and mineral oils, or for soap, alcohol or water, and vegetable oils, and as solvents for sterols, phosphatides, dyes, or pharmaceuticals. They have been found to act as pour-point depressants for lubricating oils, as crystallization inhibitors for certain vegetable oils, as stabilizers for antidetonant solids suspended in fuels, as dispersing agents for peanut solids in peanut butter and for cocoa in chocolate fat, as solvents for metallic soaps, as water-absorbent bases for suppositories. They are used in preparing specimens for the microtome. They are useful stabilizers for quick-breaking insecticidal spray emulsions. In general, they are most useful where action on a non-aqueous medium is more important than that on an aqueous one.

The water-soluble group of the non-ionic surface-active agents resembles the dispersible type, but it is no longer easily compatible with all non-polar solvents. Aqueous solutions of these compounds are opalescent or even completely clear. In this group are found compounds capable of good wetting and penetrating action, particularly for aqueous solutions of electrolytes and metallic salts. Some of the compounds are emulsifiers and dispersing agents useful under special conditions, such as high electrolyte concentration. Many also have a frothing action. There are certain emulsions which will not stand up if stabilized by compounds of the dispersible type alone, but are stable when a compound of the water-soluble type is added. Many of them will improve the stability and action of other wetting agents.

Examples of this type of compound are certain partial esters of highly polymerized glycerol and of hydroxyalkyl ethers of glycerol.

Details on Some of the Glyceryl Esters

Glyceryl Laurate S (Glyceryl Monolaurate)

Physical Properties

Color and Form	Cream, Semi-Solid
Odor	Very Faint
Melting Point	24–25° C.
pH (5% Aqueous Dispersion at 25° C.)	8.5–8.7
Specific Gravity (25/25° C.)	0.980

Glyceryl laurate S is completely soluble in alcohol, hydrocarbons, mineral and vegetable oils and is dispersible in water.

It can be used as an anti-foaming agent, e.g., for the reduction of foam in casein and similar proteins used in edible products. It is also used as a dry-cleaning soap base. It dissolves quickly and clearly in all dry-cleaning solvents, possesses high detergent value, acts as a solvent for grease and helps emulsify and remove water-soluble dirt.

Glyceryl laurate S is an ester of C.P. glycerin and lauric acid obtained from edible coconut oil and can, therefore, be considered non-toxic. It is very suitable as an emulsifying agent for the manufacture of fluid, edible, and pharmaceutical oil emulsions. It is also of interest as a smoothing and dispersing agent, particularly for proteins and similar products.

Glyceryl Monoricinoleate S (Glyceryl Monoricinoleate)

Physical Properties

Color and Form	Amber Fluid
Odor	Faint
pH (5% Aqueous Dispersion at 25° C.)	9.0–9.1
Specific Gravity (25/25° C.)	1.020

Glyceryl monoricinoleate S is completely soluble in alcohol and vegetable oils, insoluble in hydrocarbons and mineral oils, and dispersible in water.

For the manufacture of cosmetic emulsions, particularly for hair pomades, brilliantines, etc., glyceryl monoricinoleate S replaces sulfonated castor oil and has the advantage that it does not turn rancid or thicken with age. Being completely water-dispersible, it is readily removed by water. It is a good solvent for oil-soluble dyes. Because of its emulsifying properties, it enables oil-soluble dyes to be dispersed in water.

Glyceryl monoricinoleate S, being only slightly hygroscopic, non-volatile and non-drying, replaces glycerin in the manufacture of stamp-pad and similar inks.

Glyceryl Monostearate S (Glyceryl Monostearate)

Physical Properties

Color and Form	Tan, Wax-Like Solid
Odor	Faint
Melting Point	56–57° C. (Capillary Tube)
pH (3% Aqueous Dispersion at 25° C.)	9.3–9.7
Specific Gravity (25/20° C.)	0.970

Glyceryl monostearate S is completely soluble in hot alcohol, hot hydrocarbons, hot mineral oils, and hot vegetable oils. It is dispersible in hot water.

It is used as an emulsifying agent for edible, pharmaceutical, and cosmetic emulsions, e.g., for paste emulsions of edible oils, for the manufacture of greaseless creams, etc.

Glyceryl monostearate gives a good protective coating for hygroscopic powders and similar products. Edible powders, crystals, and tablets which absorb moisture from the air have a tendency to lump, cake and decompose on standing. A solution of glyceryl monostearate S in hot alcohol or other suitable solvent is sprayed on the powder, which can be tumbled in a heated barrel until all the solvent has evaporated. This leaves the product coated with a thin, protective film which is dispersed and does not prevent dissolving of the product when it is thrown into water.

Glyceryl monostearate S is also used as a small addition to oils, fats and shortenings for improving their smoothness and whiteness.

SOAP
THE BASIC INDUSTRIAL EMULSIFIER

Georgia Leffingwell and Milton A. Lesser

The industrial chemist looks upon soap not only as the most important detergent but also as the primary emulsifying agent.

The value of soap as an emulsifier is intimately bound up with its effects as a surface-active agent, that is, its ability to lower surface tension. As remarked by Snell,[1] the first surface-active agent was no doubt prepared by mixing wood ashes with fat some time prior to the invention of writing.

Soap is still considered to be the most important of the surface-active agents. Wallersteiner,[2] for example, has stated that soap is the oldest and probably most widely used surface-active agent. Despite certain disadvantages, Tomlinson[3] acknowledges that soaps are the simplest of surface-active agents.

In view of the fact that the great majority of technical emulsions are of the oil-in-water type, it is of primary importance that the familiar, water-soluble alkali soaps promote emulsions of oil in water.[1] In the ordinary sense, and in the sense employed in this discussion, soap is understood to refer to those compounds formed by the action of fatty acids or their glycerides upon the bases of sodium or potassium and, less frequently, ammonium.[4] Soap, as ordinarily available, is actually a mixture of salts of various fatty acids. Different soaps will vary in their physical and chemical properties according to the materials that went into their manufacture. Usually mixed fatty acid soaps are suitable, but on occasion the soap of a particular fatty acid is more efficient as an emulsifier or surface-active agent.[5]

From time to time attempts have been made to evaluate the emulsifying properties of various soaps. The obvious difficulty of such evaluations lies in the number of variables that must be taken into account, not the least of them being the components of the system to be emulsified. Illustrative of such studies are the investigations of King and Mukherjee[6] on kerosene-water and olive-oil-water emulsions stabilized by various soaps. With such systems they found that sodium and potassium soaps are better emulsifying agents than ammonium soaps. Consideration of the effects of the fatty acid portion of the soap indicated that the fatty acids in the order of increasing efficiency are palmitic, stearic, and oleic. It was also noted that the mechanical method of emulsification influences both the degree of dispersion and stability.

Getting down to fundamentals, it may be said that an emulsion results when two dissimilar substances, otherwise immiscible, are intimately dispersed or mixed under properly controlled conditions. Usually a third ingredient, called an emulsifier or, more properly, a surface-active agent, is required to bring about the intimate mixture or dispersion. The purpose of this emulsifying agent is to lower the interfacial tension between the two phases so that finely divided globules of one liquid will remain suspended in the other. If the water is the continuous phase, the emulsion is of the oil-in-water type; where the reverse is true the emulsion is of the water-in-oil type.[7]

Since surface-active agents comprise the most important class of emulsifiers, it is noteworthy not only that soaps were the first practically used surface-active agents, but that they still hold an outstanding, probably leading, place among such materials.[4] Indeed, according to Berkman and Egloff,[8] water-soluble sodium and potassium soaps are among the best emulsifying agents for oil-in-water emulsions. Moreover, soap can act as a good emulsifier in small amounts. They pointed out that in an emulsion stabilized with soap there are to be considered not only the dispersion of one liquid in another but also the soap-in-oil and the soap-in-water solution systems, together with their respective equilibrium factors. In addition, hydrolysis of certain commercial soaps may have an important bearing on the behavior of an emulsion system.

Except for two limitations it is a fair statement that soap meets nearly all requirements for an efficient surface-active agent. The numerous synthetics that have been developed during recent years may well be classed as attempts to provide products that will be stable at a pH below 10.2 (soap begins to decompose below this level) and which will not react with heavy-metal or alkaline-earth ions to form insoluble precipitates. This last part of the problem has been solved in part by the addition of ion exchange agents, such as the complex phosphates like hexametaphosphate and tetrapyrophosphate.[1, 2]

While most industrial applications for soap as an emulsifier or surface-active agent call for the use of prepared or preformed products, soap is sometimes formed *in situ,* the fatty acid being included in the oil phase and the alkali in the aqueous phase, and saponification taking place when the two phases are mixed. Such *in situ* formation is said [9] to have the advantage of yielding a fine dispersion. This principle is used in making bituminous emulsions, in cosmetics manufacture and in the production of certain types of polishes.

Published reports [5, 10, 11] have emphasized the industrial importance of soap as an emulsifier. From the standpoint of soap consumption, there appears little doubt that soap finds its greatest utility in the emulsion polymerization processes which form the basis of the modern synthetic rubber industry.[12, 13, 14, 15]

While the process may differ somewhat with individual manufacturers, the value and status of soap remains essentially the same with all of these methods. While soap can and has been used by the industry as a wetting, dispersing, stabilizing, and lubricating agent, essentially it is employed as a wetting agent prior to polymerization. Briefly, the substances going into the manufacture of synthetic rubber, e.g., butadiene and other ingredients, are emulsified in soapy water, the mixture being placed in a large, sealed steel kettlelike mixer and heated under pressure. The emulsion is polymerized to form a latexlike liquid similar to that which exudes from the natural rubber tree. Like natural latex, the thick white resultant mass is coagulated by acid to form a curdlike product. After washing and dehydration under pressure, the coagulated synthetic latex is ready for conversion to whatever use natural rubber would be put. As is now known, this synthetic rubber displays certain superiorities over the natural product, especially with regard to oil- and solvent-resistance.

New processes and improved technics for making synthetic rubber continue to call upon the emulsifying properties of soap.[16, 17] It is an able assistant in the reclaiming of used rubber. In general, the recovered rubber is ground up and dispersed in water by means of soap to form a latex which can be used much like natural and synthetic latices.[14] Because the amount of reclaim available is an important factor in the price of rubber goods,[5] it is interesting to note that newer methods for using such rubber, based on the use of soap as an emulsifier, have been developed.[18]

Various soaps act as efficient emulsifiers for the preparation of bituminous emulsions,[9] now so extensively used in various industries, in road construction, and road oiling, airport building, and soil stabilization.[5, 10] In their chapter on such preparations, in which many soap-emulsified bituminous products are described, Berkman and Egloff [8] state that most of the commercial asphalt emulsions are of the oil-in-water type in which the asphaltic bitumen or tar is dispersed in the water phase containing soaps. The value of soap in this connection is further at-tested[19-24] by the number of newer patents describing the preparation of asphaltic or bituminous compositions.

The use of soap to hold *mine* bituminous materials from deep deposits offers an interesting example of the applicability of this versatile emulsifier. In the method described by Subkow,[25] a soap solution is forced down into the bitumen formation and surged back and forth until an emulsion is formed. This can be pumped to the surface and, if desired, the emulsion can be resolved and the bitumen recovered.

Indicative of the importance of these bituminous emulsions is their suggested employment in making building blocks from readily available materials.[26] Only soap-emulsified bitumen and clayey soil, that from the immediate vicinity, are required. The combination is run through a mixer-extruder to form blocks which dry out in about one day. The blocks so formed are strong and smooth and are able to take nails.

Not limited to this or other construction-useful applications, soap's emulsifying action has been called into play for making paraffin compositions useful for waterproofing concrete.[27] Similar wax emulsions have been prepared for use on roads or for impregnating fibrous materials.[28]

The use of soap in the production of emulsion or so-called *water paints* presents interesting potentialities.[5] Elm and Werthan have reported the preferred use of ammonium oleate as an emulsifier suitable for making such products.[29, 30]

Cutting oils and other lubricants required in the machining and shaping of metals frequently contain substantial proportions of soap. Many of the disadvantages of straight oils, such as low heat capacity, high viscosity, and expensiveness, have been overcome by using soap to emulsify the oils with water. By such means, the cutting fluids retain the lubricating qualities of the oil, plus those supplied by the soap. Viscosity is controlled, cooling qualities enhanced, cost reduced, and, through the lowered surface tension supplied by the soap, good wetting and quick penetration to the cutting edge are attained.[5] Russian studies[31] of technical emulsions used in the machining of metals under pressure indicate that emulsions made from hardened oil and sodium oleate soaps possessed the greatest stability.

The production of insecticides is a field in which both the emulsifying and *spreading* or wetting properties of soap have enjoyed long-established use. In his discussion of insecticidal emulsions, Boyle[32] has remarked that the usual emulsifying agents are soaps of fatty acids or rosin. Usually insecticides are sold in concentrated form for dilution with water just prior to use. Soaps with a high miscibility in oils are favored as emulsifying agents, potash soaps generally being more miscible than soda soaps. However, the fatty acid portion of the molecule also has an effect, oleates being preferred to palmitates. In Boyle's opinion, sodium oleate is sufficiently miscible with nonaqueous liquids to be used as the emulsifying agent for making insecticides. While the quality of soap is not of major importance in such applications, he cites the advantages of consistent and reproducible results obtained with sodium oleate.

In a kindred field, soap is finding use as an emulsifier for making sprays designed to protect orchard trees from premature fruit drop.[5] Similarly, soap-utilizing compositions have been advocated as plant protectant spray compositions.[33] Of associated interest is the use of soap-emulsified wax compositions for protectively coating fresh fruits. To permit the use of such emulsions in hard water areas, a patent[34] specifies the inclusion of sufficient sodium hexametaphosphate to prevent the precipitation of any insoluble soaps that may be formed.

With many diverse uses in leather processing, soap emulsions are especially valuable in *fat-liquoring* compositions designed to return to the leather those natural oils and fats removed during the tanning processes.[11] Of course, numerous polishes and other products designed to maintain the suppleness and beauty of leather goods contain substantial proportions of soap.[35, 36]

As a matter of fact, most modern polishes based upon oils or waxes or both are often formulated with soap serving both as an emulsifier and cleansing agent. This is a very extensive field in itself; soaps are widely used in the formulation of emulsion-type automobile polishes,[37, 38] furniture polishes, [39, 40] floor waxes,[41] and a host of other products designed to maintain beauty and durability.[42] Of interest in this connection is the recent development of what might be termed *concentrated* polishing compositions. These products are marketable in a comparatively solid form to be mixed with hot water to form self-polishing wax-in-water composition, and their efficacy depends in large measure on the emulsifying action of soaps.

Soap retains a very substantial position as an emulsifier in cosmetics formulation.[7, 44] As remarked by King,[45] not so long ago, the oil-in-water type has the widest use in cosmetics, and, in spite of recently developed emulsifiers, these are, in the main, still soap stabilized. Although the soap is generally formed *in situ,* usually by the action of a small quantity of some alkali on stearic acid, soap as such is often employed. The production of hair creams and brushless shaving creams, as well as the still widely popular old-type honey and almond creams, to name but a few, still depends in large measure upon the use of a good grade of soap.

It might be well at this time to point out that many so-called modern emulsifiers depend upon the presence of a small quantity of soap to act efficiently. According to Thomssen,[7] when the polyhydric alcohol esters are modified by the addition of soap, they become self-emulsifying or act as emulsifiers. This fact has been given added emphasis in Redgrove's discussion of glyceryl monostearate,[46] perhaps the most important of these esters. Similarly, DeNavarre,[47] in considering such products, has remarked that all of the self-emulsifiers that work easily, rapidly, and surely, and which can stand abuse, contain a small amount of soap, usually from 5 to 10 per cent. In the finished product this amount of soap has little effect on the pH of the emulsion and it greatly facilitates manufacture.

REFERENCES

[1] F. D. Snell, *Ind. Eng. Chem.*, **35**, 107 (1943).
[2] W. K. S. Wallersteiner, *Soap, Perfumery Cosmetics*, **18**, 538 (1945).
[3] K. Tomlinson, *Mfg. Chemist*, **15**, 249 (1945).
[4] H. B. Burke, *Am. Dyestuff Reptr.*, **29**, 65 (Feb. 5, 1945).
[5] M. A. Lesser, *Soap*, **20**, 25 (Aug. 1945).
[6] A. King and L. N. Mukherjee, *J. Soc. Chem. Ind.*, **58**, 243 (1939).
[7] E. G. Thomssen, *Drug Cosmetic Ind.*, **56**, 580 (1945).

[8] S. Berkman and G. Egloff, *Emulsions and Foams,* New York, Reinhold, 1941, pp. 26, 29, 399.

[9] W. Clayton, *Theory of Emulsions and their Technical Treatment,* Ed. 4, Philadelphia, Blakiston, 1943, p. 287.

[10] G. Leffingwell, *Chem. Industries,* **52,** 337 (1943).

[11] D. P. Bayles, *Domest. Commerce,* **32,** 14 (Feb. 1944).

[12] Anon., *Chem. Met. Eng.,* **49,** 113 (1942).

[13] F. J. Van Antwerpen, *Chem. Eng. News,* **21,** 950 (1943).

[14] Anon., *Soap,* **18,** 29 (Nov. 1942).

[15] C. F. Freyling and E. W. Harrington, *Ind. Eng. Chem.,* **36,** 114 (1944).

[16] C. F. Freyling, U. S. Patent 2,378,693; U. S. Patent 2,378,695 (1945).

[17] N. L. Semon and C. F. Freyling, U. S. Patent 2,378,732 (1945).

[18] D. E. Fowler, U. S. Patent 2,333,420 (1943).

[19] T. K. Miles, U. S. Patent 2,378,235 (1945).

[20] W. W. DeLaney, U. S. Patent 2,350,548 (1944).

[21] A. C. Barwell, U. S. Patent 2,340,449 (1944).

[22] N. W. McLeod, Canadian Patent 417,776 (1944).

[23] H. G. Williams, U. S. Patent 2,330,100 (1943).

[24] R. A. Dunbam, U. S. Patent 2,318,932 (1943).

[25] P. Subkow, U. S. Patent 2,288,857 (1942).

[26] C. W. Murchison, U. S. Patent 2,275,087 (1942).

[27] C. H. Schuk, U. S. Patent 2,232,977 (1941).

[28] R. B. Porter, Jr., U. S. Patent 2,321,240 (1943).

[29] W. T. Pearce, *Paint, Oil Chem. Rev.,* June 5, 1941, p. 24.

[30] A. C. Elm and S. Werthan, *Official Digest, Fed. of Paint and Varnish Prod. Clubs,* Feb. 1943.

[31] A. K. Chertavskikh, *Tsvetnye Metal.,* **15,** No. 12, 76 (1940); through *Chem. Abstr.,* **37,** 2098 (1943).

[32] J. L. Boyle, *Mfg. Chemist,* **15,** 279 (1944).

[33] C. D. Dolman, U. S. Patent 2,346,362 (1944).

[34] I. J. Blondon, U. S. Patent 2,332,128 (1943).

[35] C. T. Small, *Chem. Industries,* **50,** 501 (1942).

[36] M. A. Lesser, *Soap,* **20,** 29 (Sept. 1944).

[37] C. T. Small, *Chem. Industries,* **50,** 806 (1942).

[38] R. A. Stetson, *Soap,* **21,** 32 (Jan. 1945).

[39] C. T. Small, *Chem. Industries,* **49,** 354 (1941).

[40] C. A. Tyler, *Soap,* **16,** 108 (June 1940).

[41] M. A. Lesser, *Soap,* **21,** 38 (Sept. 1945).

[42] F. W. Smither, "Washing, Cleaning and Polishing Materials," *Nat Bur. Standards Circ.,* C424, Washington, Dept. Commerce, 1939.

[43] L. C. Cartwright, U. S. Patent 2,374,414 (1945).

[44] G. Leffingwell, *Am. Perfumer,* **47,** 50 (July 1945).

[45] A. King, *Mfg. Perf.,* March 1939, p. 73.

[46] H. S. Redgrove, *Perfumery and Essent. Oil Record,* Feb. 1938, p. 46

[47] M. G. DeNavarre, *Chemistry and Manufacture of Cosmetics,* p. 197, New York, Van Nostrand, 1941.

SURFACE-ACTIVE AGENTS AS GERMICIDES*

ABRAHAM TAUB

Associate Professor of Pharmaceutical Chemistry,
College of Pharmacy, Columbia University

DURING the past decade, a new class of germicidal agents known as invert soaps or cationic surface-active agents was introduced to the pharmaceutical and medical professions. Although many chemicals in this group have been known for some time, it was Domagk, recipient of the *Nobel Prize* for his classical work on the sulfonamide dyes, who initiated the technical development of these cationic agents as bactericides. These substances are of particular interest because they have certain advantages over the more common germicides such as the phenols, dyes, iodine, mercurial, and silver compounds. The cationic agents are readily soluble in water and affect bacteria without discoloring the skin and without having any appreciable irritant, caustic, or toxic effect.

Nature of Surface Activity

The term *surface-active agent* is, perhaps, not familiar to some, although one of the earliest known surface-active agents, soap, has been widely used in the medical arts. Any substance which decreases or otherwise modifies the interfacial tension, *viz.*, the tension at the boundary surface, between two phases of matter, *i.e.*, liquid-solid, liquid-liquid, or liquid-gas, is a surface-active agent. The tension between the latter two phases has the special name of surface tension.

Surface-active agents usually are effective in small concentrations. Their applications are widespread. They may act, for example, as wetting agents, emulsifiers, dispersing agents, detergents, or foaming agents. In many agricultural or plant insecticides, soap acts as the wetting agent. A soap solution of the insecticide coats the foliage with a continuous film and obviates the formation of separate droplets which otherwise would roll off the leaves. In Volatile or Ammonia Liniment, N.F., the sodium oleate is the surface-active agent which emulsifies the sesame oil. In sulfur hair lotions, sodium lauryl sulfate may be used to advantage as a dispersing agent to form easily distributed, discrete particles of sulfur which settle lightly to the bottom, instead of remaining in the form of clumps on the surface. Sulfonated castor oil is used to help remove dirt, prior to being rinsed away from a head of hair or a textile fabric; in such cases it exerts a detergent effect. Detergency really is a combination of dispersion and emulsification. The *bubble bath* powder is a familiar carrier of several surface-active foaming agents.

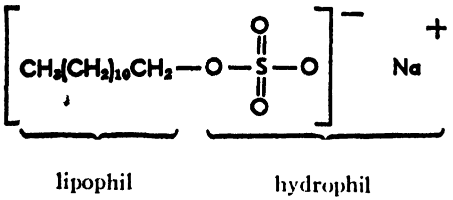
---

* Merck Report, July 1944.

Hydrophilic and Lipophilic Components

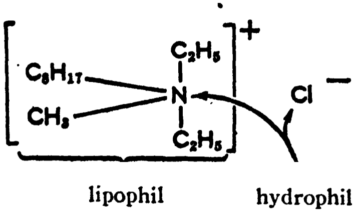
Beside the *anionic* agents, examples of which have just been cited, there are two other important subclasses, *cationic* and *non-ionic* agents. All surface-active agents may exhibit one or more of the properties indicated. Chemically, surface-active agents or interfacial modifiers consist of two component parts, a hydrophilic group which tends to make the compound water-soluble, and a lipophilic group which tends to impart oil-soluble characteristics.

In anionic agents, the lipophil group is part of a negative ion and usually is a long-chain hydrocarbon or other oil-soluble group. Sodium lauryl sulfate is an example:



$$\Big[\underbrace{CH_3(CH_2)_{10}CH_2}_{\text{lipophil}}\underbrace{-O-\overset{\overset{O}{\|}}{\underset{\underset{O}{\|}}{S}}-O\Big]^{-}\quad Na^{+}}_{\text{hydrophil}}$$

In cationic agents, the lipophilic group is part of the positive ion. These substances usually are quaternary nitrogen compounds. An example is diethyl methyl octyl ammonium chloride:



The non-ionic agents consist of two non-ionizable groups. They usually are esters of polyatomic alcohols or of polymerized glycols with fatty acids. An example is glycol monolaurate:

$$\underbrace{CH_3(CH_2)_{10}}_{\text{lipophil}}\underbrace{CO-O-CH_2CH_2-OH}_{\text{hydrophil}}$$

It has been shown that these surface-active molecules tend to orient themselves with their long axes perpendicular to the interfacial boundary. For example, when sodium oleate is placed into a container in which oil is floating upon water, the lipophilic ($C_{17}H_{33}$—) groups project upward and are dissolved in the oil phase, and the hydrophilic (—COO Na) groups project downward and dissolve in the water layer. The *hydrophilic* group is referred to as a polar group, since it has the tendency to direct the molecule into polar solvents such as water. The *lipophilic* group is referred to as a non-polar group, directing the molecule into non-polar solvents such as oils, benzene, and many other organic solvents. Through this phenomenon of orientation and selective solubility of the component parts of its molecule, the surface-active agent reduces the interfacial tension between the oil and water layers, so that upon simple agitation there is inter-mixing and dispersion of the oil in the water, resulting in an emulsion.

Germicidal Activity

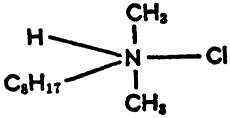
Surface-active agents frequently have been added to germicides to reduce surface tension and help penetrate wounds; also to facilitate contact with bacteria by wetting their surfaces. Surface-tension reductants also may, under certain conditions, increase the efficiency of a germicidal agent since the latter tends to concentrate in the surface film of the solution which is in contact with the bacterial organisms. Surface-active agents, by acting as detergents, may remove physically a large percentage of bacteria from the skin or from a wound. But all of these applications merely reflect the additive properties of surface-active agents when used with specific germicidal agents. They do not imply that surface-active agents are germicides in themselves. However, when these agents are chemically constituted so as to be readily adsorbed by bacterial surfaces, they then may act as antibacterial agents.

Many anionic and non-ionic agents are not as readily adsorbed by bacteria as the cationic agents. Therefore, it has been among the cationic agents that investigators have looked, within recent years, for potential germicidal agents. When cationic agents are adsorbed upon bacteria, they appear to exert a marked inhibitory effect upon the metabolism and viability of these organisms. Since they are highly surface-active, they disturb the functioning of the bacterial surface membrane. Recent studies indicate that bacteria function somewhat analogously to the base-exchange substances like Permutit and other zeolites. It will be recalled that the latter are used to remove calcium and magnesium from hard waters by exchanging such ions for sodium ions present in the activated zeolite. Such ion interchange is not limited to substances of inorganic origin. Organic resins recently have been synthesized which function in a similar capacity. One of these resins recently has been adopted by the Navy to eliminate the highly saline ions of sea water, in order to render it potable to the aviator lost at sea. It is probable that many living cells exert such base-exchange effects. As the bacteria adsorb the cationic agents, it is thought that a combination is formed which prevents or retards the normal adsorption of specific nutritional cationic substances which are necessary for the metabolic processes of the bacteria. In this manner, the cationic agents may prove to be genuinely germicidal.

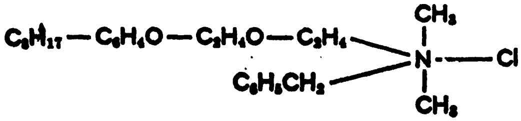
The development of these newer cationic germicidal agents is not the result of the haphazard testing of large numbers of surface-active compounds available. Many studies have been made which attempt to correlate chemical structure with germicidal efficacy. An examination of germicidally potent cationic agents indicates that in the cation there are either two or three groups of small molecular weight and one long chain hydrocarbon of six to eighteen carbon atoms, directly or indirectly attached to the quaternary nitrogen atom. The greatest efficacy is obtained when this hydrocarbon chain either is a lauryl ($C_{12}H_{25}$—), myristyl ($C_{14}H_{29}$—), or cetyl ($C_{16}H_{33}$—) group. A further qualification for effective germicidal action is that there must be a proper balance between the lipophilic group in the cation and the hydrophilic group. Such a balance is obtained by proper selection of the several lipophilic groups with regard to molecular type, molecular weight, and position or orientation in the molecule.

Proprietary Preparations

For example, the compound octyl dimethyl ammonium chloride shows a low germicidal activity. Replacing the hydrogen atom by a methyl group produces a severalfold increase in activity. Replacing it by a benzyl ($C_6H_5CH_2$—) group, still further enhances its effectiveness. The latter compound is one of an alkyl series available as a proprietary (Zephiran Chloride) which is germicidal to *Staphylococcus aureus* and *Eberthella typhosa* in a dilution of about 1:20,000.

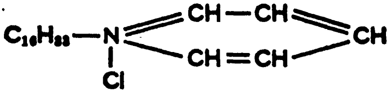


In another series of germicidal agents studied, it was found that, if the attachment of the octyl group to the quaternary nitrogen was interrupted by phenyl and ether groupings, still more potent activity toward certain organisms resulted. The proprietary compound, paratertiary octyl phenoxy ethoxy ethyl dimethyl benzyl ammonium chloride (Phemerol):

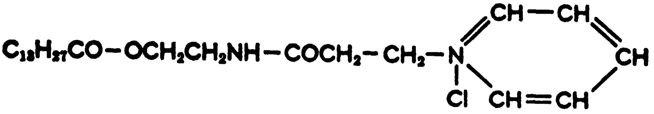


is germicidal to *Eberthella typhosa* in a dilution of 1 :9000, and to *Staphylococcus aureus* in 1 :35,000.

One other series is worthy of mention. Here the quaternary nitrogen atom, instead of being in an aliphatic linkage, is in a pyridine grouping. Cetyl pyridinium chloride (Ceepryn) is an example of a very effective germicide:



In this type of compound, the matter of obtaining a proper balance between lipophil and hydrophil groups may lead to rather complex side-chain groupings attached to the nitrogen atom. An example is myristyl colamine formyl methyl pyridinium chloride (Emulsol 607):



This is effective against both *S. aureus* and *E. typhosa* in a dilution of about 1 :30,000.

This series of cationic agents has the advantage of permitting the use of high molecular weight side chains necessary for producing lipophil properties and proper balance with hydrophil groups, without impairing their water solubility, a highly desirable characteristic of germicidal agents.

Clinical Application

These cationic agents have proved germicidal against a large variety of organisms, *i.e.*, certain gram-positive and gram-negative bacteria, as well as certain fungi. They have only slight sporicidal activity. When used in the high dilutions recommended, they are effective, nonpoisonous, and practically nonirritant to the skin. At 1:100, or higher concentrations, some of them may prove irritating if left in contact with the skin for a day or more. At 1:500 to 1:50,000 dilution, they have found extensive application as general antiseptics, and for gynecologic, ophthalmologic, dermatologic, and preoperative use. Their toxicity indices are relatively low, *i.e.*, of the order of 0.5. They generally do not corrode metallic surgical instruments, especially when 0.5 per cent sodium nitrite is added. Synthetic rubber may show slight lightening of color on long exposure, but natural rubber articles withstand fairly long contact without deterioration.

These germicides are stable in concentrated form, and in aqueous solution. They may be used in normal saline and in alcohol-acetone-water preparations. They are effective in neutral aqueous solutions, less so in acid media, and more so as the pH increases. At pH 9, the activity may be twenty times as great as at pH 7, and more than one hundred times as effective as at pH 4. This is in contradistinction to many of the more common germicides. Phenols, benzoates, mercurials, and certain anionic synthetic detergents increase in potency as the pH decreases.

Cationic agents are compatible with certain vasoconstrictors such as epinephrine and ephedrine, and also with procaine and many other local anesthetics.

Incompatibilities

Although cationic agents are highly effective at pH 9, it must not be assumed that they can be used indiscriminately with other alkaline substances. Cationic surface-active agents never should be used together with soap. The latter is an anionic agent and therefore is incompatible. Although no precipitation or other visible effect may be noticeable in the high dilutions employed, the germicidal effectiveness of cationic agents is markedly reduced or entirely destroyed by any anionic agent. Therefore, when soap is used as a detergent for the skin, it must be completely washed off with water before a cationic germicide is employed. Cationic agents are good detergents themselves and, though more costly than soap, are effective cleansers in higher dilutions.

Many of the germicidal dyes, particularly the acid types, are incompatible with cationic agents, since their color ions carry negative charges which make them similar in chemical activity to the anionic agents. However, the acridine dyes, acriflavine and proflavine, containing quaternary nitrogen atoms, act like cationic agents, and are compatible.

The importance of keeping cationic agents away from contact with anionic agents is emphasized in recent studies which indicate that germicidal action is not necessarily an irreversible process. Bacteria which presumably have been killed by cationic agents, have been rendered viable again within a short time by contact with certain anionic agents.

Conclusion

Because of the marked effectiveness of cationic agents against many organisms, it has been suggested that they might be of value as systemic chemotherapeutic agents. Experience has shown, however, that they cannot be utilized by the oral or parenteral route. The blood proteins, probably through ionic interaction, readily inactivate the cationic agents. This may be a mass-action effect, since there is a much higher ratio of proteins to cationic agents in the blood stream than in localized surface wounds. Although their potency is reduced, cationic agents are not inactivated by the presence of serum in wounds; and, despite the fact that they cannot compete with the sulfa-drugs, or penicillin, cationic surface-active agents are becoming established in medicine as effective germicides and disinfectants.

REFERENCES

Relationship of Bactericidal Potency to Length of Fatty Acid Radicals of Certain Quaternary Ammonium Derivatives. A. K. Epstein, B. R. Harris, M. Katzman, *Proc. Soc. Exp. Biol. Med.*, **53**, 238 (1943).

Toxicity Indices of Some Basic Antiseptic Substances. H. Welch and **C. M. Brewer,** *J. Immunol.,* **43,** No. 1 (Jan. 1943).

Bacterial Action of Synthetic Detergents on the Metabolism of Bacteria. Z. Baker, R. W. Harrison, and B. F. Miller, *J. Exp. Med.,* **73,** No. 2, 249 (1941).

Surface-Active Agents. F. D. Snell, *Ind. Eng. Chem.,* **35,** 107 (1943).

Relationship of Chemical Structure to Germicidal Activity of a Series of Quaternary Ammonium Salts. A. L. Rawlins, L. A. Sweet, and D. A. Joslyn, *J. Am. Pharm. Assoc.,* **32,** 11 (1943).

Bactericidal and Bacteriostatic Properties of Surface Tension Depressants. L. Gershenfeld and V. E. Milanick, *Am. J. Pharm.,* **113,** 306 (1941).

C. M. Suter, *Organic Chemistry of Sulfur;* Tetracovalent Sulfur Compounds. New York, John Wiley and Sons, 1944.

CHAPTER XII

PAPERS ON EMULSIONS

COSMETIC EMULSIONS

H. BENNETT

COSMETIC creams and milky lotions may be classified as emulsions. Soaps of one kind or another, or alkali metal salts of higher fatty acids, are common emulsifying agents, and are satisfactory to a certain extent, particularly for pastes or heavy creams. However, they suffer from a number of disadvantages, especially where fairly long shelf life is an important factor. Ordinary soaps do not, in themselves, give too high a degree of stability, particularly in liquid emulsions. Furthermore, they are somewhat reactive, and their effectiveness can be lowered by a variety of conditions. Since the soap acts as the emulsifying agent maintaining the immiscible components in a homogeneous state in the emulsion, any factor tending to inactivate the soap will adversely affect the stability of the emulsion. Fatty acid esters of certain polyhydric alcohols, while in themselves poor emulsifying agents, become excellent emulsifying agents when modified by the addition of small quantities of emulsion stabilizers.

Emulsifying Agents

Monostearin (Glyceryl Monostearate)

Monostearin is the commercial grade of glyceryl monostearate to which no stabilizer has been added. It consists of a mixture of mono-, di- and tri-stearates, and is a light cream-colored wax-like solid with a melting point of 55–57° C. It has a specific gravity of 0.970 (25/25° C.). Monostearin is insoluble in water but readily forms a milky emulsion in water containing a small percentage of soap or wetting agent, such as sodium lauryl sulfate. The addition of a wetting agent to monostearin gives an emulsifying agent particularly recommended for paste creams stable in the presence of dilute acids, salts, and other electrolytes. Deodorant creams containing benzoic acid, aluminium sulfate, etc., can very readily be made with this type of emulsifying base. In conjunction with petrolatum, monostearin makes an effective aid to absorption base creams of the water-in-oil type. It is also of interest by itself as an edible synthetic wax where its melting point and other properties are suitable.

Glyceryl Monostearate S

This is essentially glyceryl monostearate modified with a small percentage of soap. It acts as an effective emulsifying agent by itself in the manufacture of creams of the greaseless and vanishing cream type where straight emulsification of oils and waxes is desired in the absence of electrolytes. In conjunction with cetyl alcohol or a colloidal clay such as bentonite, glyceryl monostearate S makes an excellent greaseless ointment base into which can be incorporated boric acid, tannic acid, calamine, etc. Glyceryl monostearate S is a white wax-like solid with a melting point of 56–57° C. A 3% dispersion in water has a pH of 9.3 to 9.7.

Diglycol Stearate S

This is a mixed mono- and di-stearate modified with soap and containing an excess of free fatty acid. It is a white wax-like solid with a melting point of 51–54° C. (capillary tube). It has a specific gravity of 0.96 (25/25° C.). It is readily dispersible in hot water, forming on cooling, with stirring, a stable fluid or paste emulsion, depending on the amount used. A 3% dispersion in water has a pH of 6.8–7.1. Diglycol stearate S acts as an excellent emulsifying agent for oils, solvents and waxes where a stable, neutral, viscous cream-like product is desired. It is specially suitable for the manufacture of greaseless creams, brushless shaving creams and similar products. It is also of interest as a suspending medium for titanium dioxide for skin whiteners and night creams.

Glaurin (Diethylene Glycol Monolaurate)

This is a light yellow liquid with a faint pleasant odor. It has a specific gravity of 0.960 (25/25° C.), and is insoluble in water but miscible in alcohol, hydrocarbons and oils in certain proportions. It is useful in many instances for its properties as an oil, as a solvent and as a lubricant. In conjunction with small amounts of soap, it acts as an excellent emulsifying agent for the manufacture of hand lotions and similar liquid emulsions. Used in conjunction with an acid-stable wetting agent, such as Wetanol, Duponol, it can be employed as an emulsifying agent stable in the presence of dilute acids, salts and other electrolytes.

Diglycol Laurate S

This is a partial lauric acid ester of diethylene glycol, modified with a small amount of soap, and can be used directly as an emulsifying agent for liquid emulsions in the absence of electrolytes. It is a light straw-colored liquid, dispersible in water, and miscible with alcohol, hydrocarbons and oils. A 3% dispersion in water has a pH of 9.0–9.2.

Modern Cold Creams

The term *cold cream* is properly limited to traditional beeswax, borax, oil, and water creams, but it can also be applied to any white cream that contains sufficient water to tend to exert a cooling effect on the skin because of water evaporation. The regular type of cold cream generally contains 25–35% water. Small amounts of water tend to favor the production of water-in-oil emulsions. In the case of the modern type of cold cream, the water content may range from 40% to over 60% depending on the other ingredients present. Both glyceryl monostearate S and diglycol stearate S, which are somewhat similar chemically to naturally occurring fats, are used as emulsifying agents and require no additional emulsifying aids. They are both excellent emulsifying agents and are also of real use as skin softeners. Because of their fat-like qualities they may be subject to attack by certain molds, and, therefore, preservatives should always be included in formulations using fatty acid esters, particularly where shelf life is an important factor. In this connection we recommend the preservative Moldex.

Formula No. 1

Glyceryl Monostearate S	12.0
Beeswax	3.0
Spermaceti	3.0
Mineral Oil	30.0
Glycerin	8.0
Water	43.5
Moldex	0.1
Perfume	0.4

All glyceryl monostearate creams may be made by either of two alternative procedures. According to the simpler, but not necessarily better method, all of the ingredients, with the exception of perfume, are heated together to about 85° C. until the waxes, fats and oils have been completely melted and float on the water as a liquid mixture. Stirring is now started and continued until the mixture passes through the gel stage and becomes a smooth cream. Unless particular care is taken in this procedure, some wax lumps may remain undispersed.

A more usual method involves melting the waxes and oils in one pot, heating the water with the water-soluble components in another pot, and mixing both at the same temperature, 70° C. Stirring is continued until a smooth cream results and the perfume is added at 45° C., with stirring.

For creams with different consistency, texture, oiliness, etc., proportions may be varied within relatively wide limits. Oil should not generally exceed 30% of the total; glyceryl monostearate may in special cases go as high as 25%. Where the oil content is relatively high, passage of the cream while it is still warm through either a colloid mill or homogenizer almost always improves the product.

Formula No. 2

Glyceryl Monostearate S	14.0
Petrolatum	6.0
Ozokerite	2.0

Mineral Oil	25.0
Glycerin	5.0
Water	47.5
Moldex	0.1
Perfume	0.4

The type of petrolatum, whether short or long fiber, has a definite effect upon the qualities of the cream: long fiber petrolatum gives an oilier cream, whereas the preparation containing the short-fibered grade will show greater drag.

Formula No. 3

Glyceryl Monostearate S	12.0
Petrolatum	9.0
Paraffin Wax	6.0
Mineral Oil	14.0
Glycerin	3.0
Water	55.5
Moldex	0.1
Perfume	0.4

This is a less oily cream. Paraffin wax usually used in cosmetic formulation is the 125–127° F. grade; higher-melting varieties give a somewhat harder cream. Paraffin wax has the ability to harden the cream and yet permit it to melt quickly on the skin.

Formula No. 4

Glyceryl Monostearate S	15.0
Petrolatum	4.0
Lanolin	10.0
Mineral Oil	5.0
Water	65.0
Moldex	0.1
Perfume	0.9

The high lanolin content of this cream, along with glyceryl monostearate, suggests its use as a night cream. Additional perfume must be present to cover the lanolin odor.

Formula No. 5

Diglycol Stearate S	13.0
Spermaceti	8.0
Paraffin Wax	5.0
Mineral Oil	27.0
Glycerin	5.0
Water	41.5
Moldex	0.1
Perfume	0.4

This cream uses diglycol stearate instead of glyceryl monostearate, but the manufacturing procedure is unchanged.

The above creams containing more than 15% of mineral oil are useful and effective as cleansing creams. Where sufficient emollient, in addition to the glyceryl monostearate, is present, especially with reduced oil content, the creams may qualify as dry-skin cleansers or all-purpose creams.

These creams are oil-in-water products which may be washed off the skin with water.

Absorption Base Creams

Hormone creams, assuming greater importance daily, are preferably formulated on a water-in-oil basis, which seems to assure more effective skin absorption of the active product. In some cases, the oil-in-water preparation may be preferred because of its different application properties.

Water-in-oil creams formulated with beeswax, borax, oil, and water (low water and borax content) are not notably stable and are inclined to leak oil on standing. More satisfactory preparations may usually be made by the use of absorption bases. These latter ordinarily consist of petrolatum or similar petroleum products containing substantial proportions of lanolin extractives which act as water-in-oil emulsifiers. Monostearin (glyceryl monostearate, free from soap or other oil-in-water emulsifying agent) is quite effective in combination with petrolatum in helping to hold substantial amounts of water in an internal phase.

The following will make a good cream which may be modified by changes in proportions.

Lanolin Absorption Base	25.0
Petrolatum	10.0
Mineral Oil	10.0
Beeswax	5.0
Monostearin	10.0
Moldex	0.1
Perfume	0.4
Water	39.5

All of the ingredients except water are melted together and cooled to 45° C. Water at 40° C. is added slowly with vigorous stirring which is continued until the mixture has reached 30° C. If the cream is to be remelted for filling, heating must be very slow and the temperature must not be allowed to rise to the point where the cream becomes completely liquid and is likely to separate. A colloid mill is advisable in making absorption base creams.

Greaseless Creams

A greaseless cream is an emulsion cream which seems to disappear when rubbed into the skin or leaves a non-greasy film on the skin. The most popular and oldest type of such cream is the vanishing cream, although foundation creams, hand creams, protective creams, brushless shaving creams, medicated creams, deodorant creams, etc., all fall into the same class.

Vanishing Creams

The conventional type of vanishing cream consists essentially of a combination of free stearic acid and one or more stearate soaps. Potassium and ammonium soaps were first used but, more recently, have been supplemented by trigamine and triethanolamine soaps. However, the standard vanishing cream sometimes proves too drying to skins that are sensitive to such drying effects. It is desirable to have the cream free from excessive drying action. Creams made with glyceryl monostearate S are definitely emollient in action and are slow to dry out or shrink in the jar.

Formula No. 1

Glyceryl Monostearate S	12.0
Spermaceti	5.0
Glycerin	5.0
Titanium Dioxide	2.0
Water	75.5
Moldex	0.1
Perfume	0.4

All of the components, except the titanium dioxide and perfume, are heated together to 90° C. and stirred until a homogeneous mixture results. The titanium dioxide is ground thoroughly with a small portion of cream taken from the batch and then stirred into the rest. Continue stirring until the mixture passes through its pasty stage and becomes a smooth cream. Stir in the perfume at about 50° C. Titanium dioxide makes a white rather than translucent cream and has a slight whitening effect upon the skin.

A similar cream can be made with diglycol stearate S.

Formula No. 2

Diglycol Stearate S	11.0
Lanolin	3.0
Sesame Oil	3.5
Glycerin	5.0
Water	76.9
Moldex	0.1
Perfume	0.5

Again, all of the ingredients except the perfume are heated and stirred together and the perfume finally added at 50° C.

Glyceryl monostearate creams are sometimes modified by the addition of a small amount of soap made during the process by combination of potassium hydroxide with stearic acid. In this case it is advisable to use the two-pot manufacturing procedure.

Formula No. 3

Glyceryl Monostearate S	10.0
Beeswax	2.0
Peanut Oil	2.0
Stearic Acid	2.0
Potassium Hydroxide	0.1
Glycerin	3.9
Water	79.5
Moldex	0.1
Perfume	0.4

The oil-soluble ingredients are melted together to about 75° C. while the water-soluble components are dissolved in water at the same temperature. The two solutions are mixed together and stirring continued until the mixture is homogeneous; perfume is added, as usual, at 50° C., when the cream is still soft but the temperature low enough to prevent excessive volatilization.

All Purpose Cream

a	Paraffin Wax	13.6
	White Petrolatum	3.5
	Mineral Oil	13.6
	Diglycol Stearate S	13.6
b	Water	53.6
	Triethanolamine	1.6
	Moldex	0.1
c	Perfume	0.4

Heat *a* to 70° C. and stir until complete solution is obtained. Heat *b* to the same temperature and add *a* to *b*, stirring continuously while cooling. Add *c* at about 55° C. Stir and pour at 45–46° C.

Foundation Creams

Glyceryl monostearate greaseless creams are especially well suited for use as tinted make-up bases, since they do not have the high degree of oiliness associated with cold creams or petrolatum and are free from the tendency to roll on the skin which is sometimes shown by stearate creams. Since relatively large amounts of pigment must be included for covering and tinting purposes, the cream itself should be relatively soft. Red, yellow, and brown oxides are most satisfactory for tinting, being free from any tendency to *bleed.* Titanium dioxide provides covering or hiding power; zinc oxide should not be used because of its ability to react with soaps and destroy the emulsion. The amount of titanium dioxide used will depend upon the hiding power desired, more rather than less being desirable. The proportions of colors necessary to attain a desired shade are entirely dependent upon the amount of titanium dioxide used, more colors being needed to give a certain depth of tone as the amount of titanium dioxide is increased.

The foundation cream can be manufactured by first preparing the cream base, adding the white and colored pigments while the cream is still soft and then passing the mixture through a colloid mill. Better color dispersion (freedom from color streaks) is generally obtained, however, by passing the solidified cream, containing pigment, through a roller mill.

Glyceryl Monostearate S	20.0
Spermaceti	5.0
Glycerin	5.0
Moldex	0.1
Water	66.9
Pigments	3.0

Melt the glyceryl monostearate S and spermaceti at 160° F. Add the glycerin, Moldex and water, previously heated to 160° F., and stir until cool. Add the pigment and pass through a roller mill.

Hand Creams

These are greaseless creams containing substantial amounts of skin softeners, one of the most effective of which is glycerin. The usual fatty emollients, not necessary in the presence of glyceryl monostearate, tend to make the cream too greasy on the hands. Again, the use of a little titanium dioxide will leave a whiter deposit on the skin and give the illusion of bleaching.

Glyceryl Monostearate S	12.0
Cetyl Alcohol	1.0
Stearic Acid	5.0
Glycerin	12.5
Titanium Dioxide	1.0
Water	68.0
Moldex	0.1
Perfume	0.4

This cream is made in the usual way, either with one or two vessels. When only small amounts of titanium dioxide are used to whiten the cream, grinding is not necessary to obtain color dispersion; passage through a colloid mill is almost invariably beneficial as regards stability and texture of the finished product.

Industrial Protective Creams

A special type of hand cream is the industrial protective cream. As is now well known, this cream is rubbed into the skin before work that may irritate or make the hands hard to clean. After the work is completed, the hands may be easily cleaned by simply washing in soap and water. The secret of preparations of this type is the inclusion of a *barrier* substance in the cream to prevent, more than the cream itself can do, the penetration of paints, inks, oils, etc.

Formula No. 1

Glyceryl Monostearate S	12.0
Petrolatum	3.0
Beeswax	5.0
Talc	10.0
Glycerin	5.0
Water	64.5
Moldex	0.1
Perfume	0.4

The following formula is suggested by Doctors J. V. Klauder, E. R. Gross, and H. Brown, of Philadelphia (Archives of Dermatology and Syphilology, 41(2),331, Feb. 1940).

Formula No. 2

Glyceryl Monostearate S	12.0
Beeswax	12.0
Hydrous Wool Fat	6.0
Cholesterol	1.0
Sodium Silicate (Commercial Solution)	5.0
Ammonium Hydroxide (10% Solution)	0.5
Water	63.5

Melt together beeswax, glyceryl monostearate S, hydrous wool fat, and cholesterol. Heat the water to the same temperature as the wax mixture and add the sodium silicate and ammonium hydroxide solutions. Stir the aqueous solution into the wax mixture and continue stirring until it congeals. This formula gives a non-greasy preparation which dries on the skin and does not rub off. Its use is indicated as a protection against dust-borne irritants, or where the material or object must be guarded against being soiled.

Brushless Shaving Creams

Glyceryl monostearate S and diglycol stearate S are well suited for the formulation of brushless shaving creams. These are greaseless creams which keep the beard moist and support the individual hairs to permit easy shaving. In addition, the cream should be of minimum alkalinity to decrease skin irritation and to facilitate washing off the razor. A small amount of mineral oil should be present to improve lubrication. A wetting agent such as Wetanol added in small percentages increases spread and wetting characteristics.

Formula No. 1

Diglycol Stearate S	15.0
Cocoa Butter	4.0
Stearic Acid	5.0
Mineral Oil	1.0
Glycerin	5.0

Water	69.5
Moldex	0.1
Perfume	0.4

Formula No. 2

Glyceryl Monostearate S	12.0
Spermaceti	4.5
Mineral Oil	2.5
Glycerin	7.0
Water	73.5
Moldex	0.1
Perfume	0.4

Formula No. 3

Diglycol Stearate S	14.0
Stearic Acid	6.0
Mineral Oil	1.0
Glycerin	5.0
Water	73.5
Moldex	0.1
Perfume	0.4

The diglycol stearate S or glyceryl monostearate S is melted with the stearic acid and other waxes and oils at 75° C. while the glycerin, water and preservative are heated together to about the same temperature. The two solutions are mixed together and stirring continued until homogeneous. The perfume is added at about 50° C. when the cream is still soft and the temperature is low enough to prevent excessive volatilization.

Medicated Creams

These are creams selected according to texture and consistency along with small proportions of medicaments, usually a combination of antiseptic oils and skin stimulants. In some cases care must be exercised in avoiding incompatible combinations among the active ingredients themselves as well as with the emulsifying agent. When the added medicaments are electrolytic in nature, monostearin should be used, together with an electrolyte-stable wetting agent, such as Wetanol. Glyceryl monostearate S can also be used for this purpose, together with a colloidal clay such as bentonite.

Medicated Cream Formula

Glyceryl Monostearate S	18.0
Spermaceti	5.0
Carbitol	5.0
Water	70.8
Menthol	0.2
Camphor	0.5
Phenol	0.1
Clove Oil	0.2
Eucalyptus Oil	0.2

Medicated Cream Base Formula

Glyceryl Monostearate S	10.0
Glycerin	25.0
Bentonite	2.0
Water	63.0

The bentonite is mixed with 50 parts of the water. The glyceryl monostearate S is melted in the glycerin on a water bath. The bentonite mixture and the balance of the water are added at the same temperature, and the mixture stirred until cool. This can be used with various medicaments such as tannic acid, iodine, phenol, benzoic acid, calamine and potassium iodide.

The following formulae are suggested for the manufacture of sulfathiazole creams.*

Formula No. 1

Glyceryl Monostearate S	12.0
Yellow Wax U.S.P.	2.0
Glycerin	6.0
Corn Oil	4.0
Water	76.0
Sulfathiazole	5.0

---

* Calco Chemical Company, Boundbrook, N. J.

Formula No. 2

Glyceryl Monostearate S	12.0
Mineral Oil	20.0
Petrolatum	20.0
Water	48.0
Sulfathiazole	5.0

Formula No. 3

Glyceryl Monostearate S	12.0
Mineral Oil	15.0
Petrolatum	20.0
Stearic Acid	5.0
Lanolin	5.0
Water	43.0
Sulfathiazole	5.0

Melt all the components, except glycerin, water and sulfathiazole, together to about 160° F. Heat the water containing the glycerin, when it is present in the formula, to 160° F. and add to the melted oils, etc. Stir until cool, and add the sulfathiazole powder with stirring. Age at least overnight, and stir well before packaging.

Deodorant Creams

Deodorant creams may be divided into two categories: those that are merely deodorant, and those that have anti-perspirant action in addition. The first type is customarily formulated around a mixture of benzoic acid and zinc oxide in which deodorant action is due to the antiseptic and preservative properties of the chemicals. They are presumed to prevent bacterial decomposition of perspiration and thus retard development of odor. The zinc oxide and benzoic acid are usually used in a petrolatum or lard base, but a better and greaseless cream can be made with glyceryl monostearate.

Formula No. 1

Monostearin	13.5
Duponol C	1.5
Benzoic Acid	4.0

Zinc Oxide	10.0
Glycerin	5.0
Water	61.5
Perfume	0.5

All of the components, with the exception of the zinc oxide, benzoic acid, and perfume, are heated together to 85–90° C. until the glyceryl monostearate melts and stirring gives a homogeneous liquid emulsion. The mixture is allowed to cool to 50° C., at which point the perfume is stirred in. The cream is allowed to cool to room temperature, preferably by standing overnight. The benzoic acid and zinc oxide are ground into the cream by means of a roller mill.

A truly anti-perspirant cream must include an astringent aluminum salt, the sulfate being generally selected. Although this salt is less strongly acid than aluminum chloride, it is still substantially acid and will cause deterioration of fabrics. For this reason, a buffer to reduce acidity, such as urea or a similar compound, may well be included. The urea content should be about 50% of the aluminum sulfate. Manufacture of an anti-perspirant cream is somewhat difficult and directions must be rigorously followed.

Formula No. 2

Monostearin	20.0
Duponol C	2.0
Ceresin	5.0
Titanium Dioxide	1.0
Moldex	0.1
Glycerin	8.0
Water	39.5
Perfume	0.4
Aluminum Sulfate	12.0
Water	12.0

Heat together to about 90° C. all of the ingredients with the exception of the perfume, the aluminum sulfate, and the water to dissolve the aluminum sulfate. Stir until homogeneous, allow to cool to 50° C., and add the perfume. The perfume should be specially selected so that it is stable in the presence of aluminum sulfate. Meanwhile heat the aluminum sulfate with an equal weight of water until it dissolves and filter through cloth. An iron-free grade of aluminum sulfate should be used to minimize discoloration. The cream and aluminum sulfate solution must be cooled to 40° C. (or preferably allowed to stand overnight at room temperature) and thoroughly mixed. The cream will not be stable if this temperature is exceeded.

Formula No. 3

a	Monostearin	5.0
	Stearic Acid	15.0
	Moldex	0.1
b	Glycerin	8.0
	Duponol C	0.5
	Water	30.0
c	Perfume	0.4
d	Aluminum Sulfate	15.0
	Urea	8.0
	Water	18.0

Melt the ingredients of group *a* together at 80° C. Add the glycerin and Duponol to water at 85° C. Thoroughly mix *a* and *b* and continue stirring until the solids are dissolved and strain through cloth. Mix the cream with solution *d* at 40° C., no higher. The perfume is added with stirring.

Liquid Creams

Liquid creams, with and without oils, can be made with the assistance of glyceryl monostearate S, diglycol stearate S and diglycol laurate S.

Hand creams should contain little oil, since an excessive proportion of mineral oil would tend to leave the hands greasy. A small amount of alcohol can be included in the preparation to accelerate drying. The use of emollients such as lanolin in addition to fatty acid esters is advantageous. In any event, lotions based upon glyceryl monostearate and similar compounds will be far more beneficial to the skin than customary soap-stearic acid products. Some glycerin should be present for its skin-softening effect; excessive amounts, however, will retard drying on the hands. Finally, small proportions of gums in the finished product give smoothness of application that is very popular.

General directions for the manufacture of greaseless lotions are simple. The emulsifying agent (glyceryl monostearate S or diglycol stearate S), oleic acid, mineral oil, and whatever waxes or wax-like materials are present in the formula, are all melted together and stirred. The water-soluble materials, with the exception of the alcohol and gum solution, are mixed with the water, heated to approximately the same temperature, and added with high-speed stirring to the melted wax-oil mixture. The stirring is continued to about 50° C. The alcohol, gum solution, and perfume are then added, and stirring continued until the emulsion is cool. A colloid mill is preferable to ordinary high-speed stirring and should be used wherever possible. In this case the emulsion should be passed through the mill before the alcohol, gum solution, and perfume are added. These materials should be added as before at about 50° C. A colloid mill gives much finer emulsions, resulting in a smoother and more stable product. A high-speed mixer also gives excellent results but on no account should reliance be placed on ordinary hand mixing. The results obtained are erratic and the shelf life of the finished product is always much shorter.

Formula No. 1

Glyceryl Monostearate S	3.5
White Oleic Acid	2.0
Glycerin	5.0
Triethanolamine	0.8
Moldex	0.1
Water	81.2
Alcohol	7.0
Perfume	0.4

Formula No. 2

Diglycol Stearate S	5.0
Cetyl Alcohol	1.0
White Oleic Acid	2.0

Mineral Oil	1.0
Moldex	0.1
Water	39.5
Perfume	0.4

Formula No. 3

Diglycol Stearate S	1.7
White Oleic Acid	0.7
Triethanolamine	0.3
Mineral Oil	2.0
Glycerin	3.0
Spermaceti	0.5
Moldex	0.1
Water	74.2
Karaya Gum	0.1
Water	10.0
Perfume	0.4
Alcohol	7.0

Liquid cleansing creams containing substantial amounts of oil can be made with the help of diglycol laurate S, a liquid emulsifying agent. The procedure is again extremely simple. The self-emulsifying diglycol laurate S is mixed with the non-aqueous ingredients including perfume, applying gentle heat if necessary to obtain a clear solution. The water is added slowly with high-speed agitation and the cream passed through a colloid mill.

Formula No. 4

Diglycol Laurate S	3.0
Cetyl Alcohol	1.0
Mineral Oil	10.0
Moldex	0.1
Perfume	0.4
Water	85.5

Formula No. 5

Diglycol Laurate S	10.0
Mineral Oil	30.0
Moldex	0.1

Perfume	0.6
Water	59.3

Mascara

Cake mascara should be readily emulsifiable and should come off easily onto a moistened brush, be applied easily to the lashes, and be water-resistant when on the lashes. Glyceryl monostearate S is highly satisfactory as a base for products of this type. Triethanolamine stearate is added to increase water solubility (discharge to the brush), and waxes, to provide water resistance. About 10% of pigment is generally required, and aniline colors must not be used.

Formula

Glyceryl Monostearate S	50
Stearic Acid	20
Triethanolamine	10
Beeswax	10
Pigment *	10

The ingredients are simply melted and stirred together. Grinding is usually not needed when finely ground cosmetic pigments are used.

Miscellaneous

Permanent Wave Cream

a	Diglycol Stearate S	9.4
	Lanolin	1.7
	Wetanol	0.1
	Water	37.3
b	Ammonia (28° Bé)	7.0
	Ammonium Carbonate	4.7
	Sodium Sulfite	9.5
	Water	30.3

---

* For a black mascara, use ivory black, cosmetic grade. Burnt umber can be used for dark brown mascara, and cosmetic ultramarine for blue. Green mascara can be made by using a cosmetic grade of hydrated chrome oxide, and purple is obtained by mixing cosmetic ultramarine with cosmetic carmine.

In *a,* melt the diglycol stearate S and lanolin together to 160° F. Dissolve the Wetanol in the water, heat to 160° F., add to the oil phase, and stir until cool.

In *b,* dissolve the ammonium carbonate in the water, allowing to stand overnight if necessary for complete solution. Add the ammonia; add the complete mixture cold, with agitation, to *a* and stir until homogeneous.

Liquid Stocking

Formula No. 1

Mineral Oil	1.0
Glyceryl Monostearate S	6.0
Water	48.0
Glycerin	15.0
Titanium Dioxide and Earth Pigments	21.0
Talc	9.0

Heat the mineral oil and glyceryl monostearate S to 160° F.; add the water and glycerin previously heated to 160° F. Stir until cool, and mill in the titanium dioxide and earth pigments, and the talc.

Formula No. 2

Glyceryl Monostearate S	0.4
Water	78.1
Glycerin	0.5
Titanium Dioxide and Earth Pigments	20.0
Methyl Cellulose	1.0

Dissolve the glycerin in the water and make a 5% dispersion of the glyceryl monostearate S and glycerin in hot water, stirring until cool. Soak the methyl cellulose in the balance of cold water until dissolved. Add this to the glyceryl monostearate dispersion and mill in the pigments.

DYE EMULSIONS

JESSE WERNER
General Aniline Works

MULTI-PHASE systems (emulsions, dispersions, and suspensions) containing dyestuffs are used for a great variety of purposes and find applications in many fields. Coloring matters may be added purely for decorative purposes, i.e., to enhance the sales appeal of products or to serve as simple visual distinguishing trade-marks. More often, the dyestuffs form an important, integral part of the mixture and are added only for utilitarian reasons. Dye emulsions are in many instances made up solely for application of the contained dyestuff, so that the emulsion becomes mainly a carrying medium for the coloring matter.

Practically all classes of dyestuffs find application as additives to, or integral units of, various types of multi-phase systems. Acid dyes, basic dyes, direct cotton dyes, mordant dyes, acetate silk dyes, vat dyes, azo dyes, sulfur dyes, cyanine dyes, organic pigments, and inorganic pigments, among others, may be found in practical use as components of such mixtures. Specific requirements for the coloring matter will dictate the type to be used. When incorporated for decorative or identification purposes, the important qualities are solubility, color value, brightness, stability, and light-fastness. Since very little is generally used, price does not matter. However, the solubility and compatibility characteristics of the dyestuff must be studied carefully in order to avoid spoiling the otherwise satisfactory qualities of the particular composition. In this connection, it is important to mention that dyestuffs have in some cases been observed to act as emulsion breakers. In emulsions, the oil or water, or both, may be colored. When used as utilitarian components of multi-phase systems, the choice of dyestuff or dyestuffs will depend upon the use, the price and the stringency of requirements for tinctorial strength, shade, brightness, and fastness.

Insofar as multi-phase systems which contain dyestuffs are concerned, there may be mentioned: dyeing and printing emulsions and dispersions, emulsion and other priming inks, oil, water, and emulsion paints, photographic film emulsions, shoe creams and polishes, food emulsions, etc. The coloring matter may be soluble in one or more of the liquid phases of an emulsion, may be finely divided enough to give a dispersion, or may be so coarse that only a suspension is possible. The physical characteristics of the dyestuff chosen will depend upon the ultimate use of the mixture.

In the textile field, multi-phase systems containing coloring matters find many and varied applications. Insoluble dyestuffs which affix themselves by chemical or physical means, such as vat dyes, acetate silk dyes, and pigments for paper, are generally sold as dispersions in water (pastes), or dispersed powders which wet out and disperse very readily in water. When used for dyeing, the pastes generally contain dyestuff, water, surface-active agents (wetting, dispersing, leveling, and antifoam), and dyeing assistants. When used for printing, thickeners and printing assistants are added. In addition, reducing or developing agents are used as necessary for the particular type of dyestuff employed.

In addition to water dispersions of dyestuffs, emulsions of oils and water containing dispersed dyestuffs have been used for various purposes. They are employed extensively at present for pigment dyeing and printing.

An old type of mordant dyeing, known as the *Old Red* process for producing Turkey red, involved treatment of the cloth with tournant oil (rancid olive oil) and potash before treating with an aluminum mordant and alizarin. This process has been largely supplanted by the *Mixed Red* and *New Red* processes, which use sulfonated castor oil as partial and complete replacements, respectively, for the tournant oil. The old method is still used to some extent for mercerized yarn, since it gives extremely fast dyeings.

Dyeings of warps, particularly pale and medium shades on cheap goods, are often made in the size machine. In this way, the warps are sized and dyed at the same time. Direct, acid, and basic colors may be used. The size generally contains an emulsion of tallow or sulfonated tallow, together with starch, glue, fats, soaps, salts, wetting agents, waxes, etc. Dyeings made with sulfur dyes on the jig may often be improved considerably by an after-treatment with an emulsion containing soap or emulsifying agents together with mineral oil, olive oil, or olein. This is helpful in removing bronzing due to too deep dyeing. A typical emulsion used for this purpose is made by dissolving 10 parts of Nekal AEM in 50 parts of water at 160° F. by stirring, adding to this 200 parts of mineral or olive oil very slowly with good stirring, and then stirring this into 400 parts of water at 160° F. The resulting emulsion is completely miscible with water.

A recent development, which shows a great deal of promise, is the method of emulsion dyeing and printing carried over from the printing ink field to the coloring of fabrics, such as the Aridye and Sher-dye processes. These involve the application of resin-bonded pigments to cotton, rayon, acetate silk, nylon, and other fabrics. The pigment is colloidally dispersed in a solution of synthetic resins. This dispersion may be applied to the fabric as such, but more often it is emulsified with water, which may be the inner or outer phase. Generally the water-in-oil type is used. Although it is more expensive, it usually produces more desirable results in printing or dyeing. A process very similar to these is the Gensa process of the General Dyestuff Corporation. This involves the application of pigments from a dispersion in a water solution of resins that are fixed by means of heat and mild acid. These methods have been used very successfully on a number of fibers, and show particular advantages on such materials as glass cloth or rubberized cloth, which cannot be colored any other way with any degree of ease. In general, dyeing or printing with these dispersions or emulsions involves applying the color to the fabric by padding or printing, drying, and curing. The curing is usually done at about 300° F., and this serves to set the resin binder and make it resistant to washing, dry cleaning, crocking, etc. Soaping afterwards is optional, and may be done to soften the hand and remove excess pigment.

In the field of printing inks, vehicles are often emulsified for a variety of reasons. Dispersion of the pigments may be improved, drying of the pigments may be avoided, and the cost of the ink lowered. In addition, emulsion-printing inks usually dry rapidly and show advantages for special purposes. Emulsion inks are found in use in intaglio, typographic or relief, and planographic printing. They may be oil-in-water or water-in-oil emulsions. Emulsion inks generally contain pigments, extenders, oil, non-aqueous solutions of resins or waxes, water, surface-active agents, and modifiers. Usually stabilizers and protective colloids are added since one of the prime requisites is a very stable, non-settling, non-separating emulsion. The emulsifying agent sometimes improves the dispersion of coloring matter by acting as a pigment-wetting agent.

Proteins, lecithin, cellulose sulfite waste liquor, sulfonated oils, alkyl naphthalene sulfonic acids, and soaps such as morpholine or triethanolamine stearate have been used extensively as emulsifying agents. Mahogany sulfonates, gums, pectins, and tannins are generally used as stabilizers. Deliquescent salts and glycerol are frequently used to prevent dampening of paper in planographic printing.

Pigments should be free from all acidic and gritty substances when used for planographic inks. They must also be insoluble in water, otherwise bleeding occurs in lithographic and offset printing. For planographic printing, the pigments should have great color strength. Where active metals are used in the plates, the pigments must be chemically inert to them. Intaglio inks require soft, non-abrasive pigments, but high color strength is not a prime requirement. In typographic inks the concentration of pigment is usually quite high to prevent offset. Therefore pigments which require little oil vehicle (low oil absorption) are generally used. The other requirements are not too stringent. In general, soft pigments, i.e., pigments that develop maximum color strength with a minimum of grinding in the vehicle, are most desirable from an economic point of view.

To prevent settling of pigments in the ink, aluminum stearate has been used. Where the emulsion is of the oil-in-water type, oil-soluble dispersing agents are generally used, since the pigment is assumed to be in the oil phase. With water-in-oil emulsions, the reverse is assumed, and water-soluble dispersing agents are employed.

To generalize for all types of printing inks, pigments should have maximum color strength, cleanliness, small particle size, ease of grinding, fastness to light, chemical inertness, and should show non-bleeding in oils, solvents, and water. Concentrated colors are particularly desirable in formulating an ink, since a minimum film will prevent offset, or partial transfer of freshly printed ink to the underside of sheets stacked up in a pile.

U. S. patent 2,120,588 gives a very good example of an emulsion typographic ink. A pulp consisting of 25% of a pigment, such as Red Lake C toner, 25% of water, and 5% of a wetting agent, such as lauryl sulfate, is mixed thoroughly with 15% of linseed varnish, 16% of blown linseed oil, 12% of petrolatum, and 2% of a drier, such as lead naphthenate.

Another case of dyes used in emulsions is in the field of latex-dipping. Brightly colored rubber articles may be made by dipping forms coated with latex containing dispersed pigments into coagulating solutions, such as acetic acid. The pigmented latex is mixed with sulfur and accelerator activator, such as zinc oxide or zinc stearate, and the coagulated and shaped article dipped into a hot solution or emulsion of accelerator, such as sodium diethyl dithiocarbamate or derivatives of pentamethylene dithiocarbamic acid. The accelerator is not put into the latex before dipping and coagulating since the latex might vulcanize on storing. By this process, the colors obtained are very bright, since the vulcanization temperature is low and the dyestuffs do not deteriorate as they often do in normal vulcanization by steam under pressure. Latex films, after coagulation and partial or complete drying, may be vulcanized in a short time below 100° C. by using ultra-accelerators. The resulting films are extremely strong and tenacious, and may be softened by incorporating cheap petroleum oils without too great a loss in strength. This method is therefore a great improvement over the older sulfur chloride vulcanization method. For colored goods, the method is used extensively. The pigments are added to the latex in the form of very fine dispersions in water.

Another field in which dyestuff emulsions have found a very wide scope of application is that of the newer emulsion paints. Emulsion paints show a number of very decided advantages over the older type of straight oil paints. They are much cheaper and distinctly less flammable. They brush and dry very easily, and give less noxious odors on drying. They may be applied on porous or wet surfaces and give bright, well-hiding, flat coats. To more or less balance these advantages, they show just as decided drawbacks. The films are usually inferior in quality, i.e., they are porous, somewhat poor in weather and wash resistance, and have practically no gloss.

The formulation of emulsion paints that overcome these bad features would be a step of major importance to the paint industry. However, the compounding of such paints is quite an art and takes a great deal of practical experience, so that major improvements come rather slowly.

Generally, emulsion paint is supplied as a dispersion of pigment in a concentrated emulsion, to be cut with 2 to 4 quarts of water to the gallon for brushing consistency. The original paste must therefore be formulated very carefully in order to obtain a product that will show no lumping or emulsion breaking on mixing with water by means of a paddle. The resulting paint may settle slightly, but should remain in a usable condition for at least a day. The paint may be applied by brushing, spraying, dipping, and roller-coating.

The most used form of emulsion paint is the oil-in-water type. Aside from water, drying oils, resins, and driers, various other components are used. Emulsifying agents are usually inorganic or organic soaps, sulfated or sulfonated products, and other wetting agents. Generally fatty acid esters of polyhydric alcohols are very helpful as emulsion-stabilizers. Bodying agents, such as gums and methyl cellulose, are often used. Protective colloids, such as casein, are employed to improve emulsion stability. Preservatives are necessary to prevent these from decomposition. Additional additives are sometimes used, such as anti-foam agents, e.g., pine oil, Foamex, Killfoam, and octyl alcohol. Most emulsions are slightly alkaline (pH about 8). However, each emulsion is a completely individual case, and must be tested extensively before it can be pronounced usable.

For oil-in-water emulsions, metal resinates should be avoided, since they tend to invert the emulsion. Most water-soluble solvents tend to ruin emulsions, and should be avoided. Pigments that react with the alkali present or the dispersing agents present, should be avoided. Finely divided carbon may also cause difficulty. Various types of pigments have found extensive use. Among them are titanium dioxide, Hansa yellow, Heliogen Green, Heliogen Blue, iron oxide red, and iron oxide black. The pigments should preferably be soft, non-gritty, and easily dispersible.

An example of a durable exterior pale blue emulsion paint is the following:

In a dough mixer, mix thoroughly 400 parts of Aquaplex S-6, 100 parts of titanium dioxide (non-chalking), 100 parts of barium Titanox (non-chalking), 25 parts of silica, and 25 parts of mica. This is then tinted to the desired shade with a similarly prepared paste of 100 parts of Heliogen Blue B, 800 parts of Aquaplex S-6, and 50 parts of water. The final tinted paste is reduced to brushing consistency with about one-half part of water to one part of paste.

EMULSION PAINTS*

Austin O. Allen
Vice-President Vita-Var Corporation

Emulsion paints are now generally recognized as highly satisfactory decorative finishes for interior wall work. The so-called resin emulsion paints are far superior to their predecessors, casein emulsion paints. Today, a well-formulated emulsion paint has practically all of the desirable properties of the best oleoresinous or oil-type interior finishes. It is possible to make emulsion paints in flat, semi-gloss, or gloss finish.

---

* The writer wishes to express his appreciation to Mr. W. G. Armstrong of E. I. duPont de Nemours Co. and Mr. J. A. Lutz of Titanium Pigment Co. for their assistance.

Emulsion paints differ from the conventional oil or oleoresinous finishes in that the emulsion paints can be thinned with water for application, whereas the conventional type paints must be reduced with volatile solvents. This is accomplished by the addition of an emulsifying agent which makes the non-compatible water and oil mixture into a two-phase dispersion. Any desired vehicle with emulsifying material, water and the proper stabilizing material can be pigmented in the conventional manner to form water-reducible emulsion paints.

Water may be either on the outside or the inside phase of the dispersion. The type using water as the exterior phase is the emulsion commonly used. Further reduction with water will reduce the consistency of this type of emulsion.

Careful selection of pigments, binder, emulsifying material and stabilizing material must be made to insure:

1. A stable emulsion paint with satisfactory package stability.
2. An emulsion paint with satisfactory application properties, good hiding and good film properties.

A wide variety of vehicles can be used as binders in resin emulsion paints. It is only necessary to select pigments which are non-reactive with the vehicle selected, and also to select the proper emulsifying material to produce a perfect emulsion with the vehicle selected.

The following is a list of vehicles which have been successfully used:

Bodied linseed oil
Bodied dehydrated castor oil
Ester gum linseed oil varnish
Ester gum dehydrated castor oil varnish
Maleic resin linseed oil varnish
Maleic resin dehydrated castor oil varnish
Modified phenolic resin linseed oil varnish
Modified phenolic resin dehydrated castor oil varnish
Alkyd resin
Acrylic resin
Vinyl resin
Chlorinated rubber

It is advisable to eliminate the use of volatile solvents, as these materials introduce objectionable odors and also have an adverse effect upon emulsion stability. Where sodium hydroxide or ammonium hydroxide is added directly to the vehicle to form a soap for emulsifying, it is necessary to have a vehicle with an acid number of approximately 12. Free fatty acid can be added to a more neutral vehicle to increase the acid number. Other emulsifying and wetting agents can be added to give more complete dispersion of the water and oil phases. Some of the materials commonly used for this purpose are:

Soaps, such as sodium linoleate or ammonium linoleate
Sulfonated vegetable oils
Sulfonated fats
Sulfonated fatty acid esters
Mineral oil sulfonates
Higher sulfonated alcohol derivatives
Triethanolamine
Morpholine
Glyceryl or glycol monoesters, e.g., glyceryl monooleate
And many proprietary products

It is necessary to keep in mind that in order to have good washability characteristics, the emulsifying material used must either leave the film or change to a water-insoluble condition in the dry film.

It is usually necessary to use a stabilizing material or protective colloid to keep the oil and water phases dispersed to insure stable emulsion paints with good package stability. The following stabilizing materials are among those commonly used:

Albumen
Alginates
Casein
Dextrins
Gelatin
Lecithin
Methyl cellulose
Carboxy methyl cellulose
Soya protein
Starches
Many water-soluble gums

Preservatives must be used where casein or other protective colloids subject to putrefaction are incorporated in the emulsion paint. The chlorinated phenol types available under a variety of trade names, e.g., Moldex, are most commonly used.

The following is a typical emulsion vehicle and its method of manufacture:

Oil Phase

Ester Gum	27.20 lb.	Duponol ME Dry	0.56 lb.
Alkali-refined Linseed Oil	50.90 lb.	Cobalt Linoleate	0.74 lb.
Z-3 Heat-bodied Linseed Oil	55.50 lb.	Lead Linoleate	6.10 lb.
Linseed Fatty Acids	2.78 lb.	Ammonium Hydroxide (28%)	1.17 lb.

Dissolve the ester gum and about one-half of alkali-refined linseed oil at a temperature of about 375° F. Then add balance of alkali-refined linseed oil, bodied linseed oil, linseed fatty acids, Duponol, cobalt linoleate, lead linoleate and ammonium hydroxide, with constant stirring.

Water Phase

Alginate (Sodium or Ammonium)	1.33 lb.	Dowicide G	5.93 lb.
Hot Water (150° F.)	296.00 lb.	Pine Oil	4.90 lb.
Dowicide A	5.93 lb.	Antifoam *	4.90 lb.
		Muriatic Casein	47.40 lb.

Add alginate to about 90 lb. of the hot water and allow to stand and swell.

Put the balance of hot water in a tank with good agitation, add the casein slowly. Then add the fungicides, pine oil and antifoam. Finally add the alginate mixture and continue agitation until all casein is in solution.

Emulsion Vehicle Preparation

Add the oil phase gradually to the water phase with constant agitation until the emulsion is uniform. Then add 330 lb. of water and continue stirring until the emulsion is uniform.

The properly prepared emulsion vehicle can be pigmented in the same manner as conventional coatings by mixing the selected pigments into the vehicle and grinding on conventional grinding equipment, such as a roller mill, stone mill or colloid mill.

---

* Foamex or Diglycol Laurate S.

The pigment-non-volatile vehicle ratio can be varied through a very wide range. The higher pigment-non-volatile vehicle ratio will give coatings with a flat finish and the lower pigment-non-volatile vehicle ratio will give a gloss finish. Intermediate combinations will give various degrees of semi-gloss finishes. In order to produce gloss finishes with satisfactory hiding it is necessary to use pigments with maximum opacity, such as pure titanium dioxide. Some of the pigments commonly used are:

Opaque pigments	Inert pigments
Pure titanium dioxide	Magnesium silicate
Titanium calcium pigments	China clay
Titanium barium pigments	Barium sulfate
Lithopone	Silica
Zinc sulfide	Mica

A few typical emulsion paint formulae are given below. As previously pointed out, wide variations can be made by selecting various types of resins, oils, emulsifying material, protective colloids, preservatives and pigments. Colored pigments may be added to give any desired tints.

Formula No. 1

Pure Titanium Dioxide	100 lb.
Lithopone	400 lb.
China Clay	180 lb.
Mica	100 lb.
Emulsion Vehicle	620 lb.

The emulsion vehicle can be prepared as previously described.

Formula No. 2

Pure Titanium Dioxide	200 lb.
China Clay	360 lb.
Mica	100 lb.
Emulsion Vehicle	620 lb.

The emulsion vehicle can be prepared as previously described.

Formula No. 3

Lithopone	475 lb.
Zinc Sulfide	183 lb.
Diatomaceous Silica	72 lb.
Resin-oil Emulsion Vehicle	645 lb.

The emulsion vehicle can be prepared as previously described.

Formula No. 4

Pure Titanium Dioxide	200 lb.
China Clay	800 lb.
Ester Gum-linseed Oil Solution	72.4 lb.
Blown Linseed Oil	98.4 lb.
Pine Oil	3.8 lb.
Sodium Hydroxide	2.0 lb.
Dowicide A	6.5 lb.
Lanolin	2.0 lb.
Casein	50.0 lb.
Water	625.0 lb.
Lead Naphthenate (16% Lead)	14.2 lb.
Cobalt Naphthenate (4% Cobalt)	3.1 lb.

The following procedure in preparation has been found to give good results:

1. Mix casein in one-half of the water (hot).
2. Add the pine oil to the above mixture.
3. Dissolve the sodium hydroxide and Dowicide A in the remaining water and then add to the casein slurry and mix until smooth.
4. Mix the driers, ester gum varnish, blown linseed oil and lanolin until smooth and add to the casein—sodium hydroxide slurry. Agitate until viscosity increases or there is an indication of the casein swelling.
5. Add pigments and mix until smooth.
6. Grind through roller or stone mill. A loose pass through the mill followed by a medium grind gives better results than a single pass.

Formula No. 5

Pure Titanium Dioxide	400.0 lb.
Magnesium Silicate	600.0 lb.
40-Gallon Ester Gum Linseed Oil Vehicle (100% Solids)	35.0 lb.
Sulfonated Castor Oil (75% Solids)	2.5 lb.
Casein (Muriatic)	10.0 lb.
10% Sodium Hydroxide Solution	3.5 lb.
Methyl Cellulose	5.0 lb.
Lead Naphthenate (24% Lead)	18.0 lb.
Cobalt Naphthenate (6% Cobalt)	5.0 lb.
Water	27.0 lb.

The procedure described under Formula No. 4 can be followed for the preparation of the above emulsion paint.

Formula No. 6

Titanium Calcium Pigment	900.0 lb.
Diatomaceous Silica	70.0 lb.
40-Gallon Ester Gum-linseed Vehicle	33.0 gal.
Sulfonated Castor Oil (75% Non-vol.)	5.0 gal.
Emulsifying Agent *	3.5 gal.
Casein	10.0 lb.
10% Sodium Hydroxide Solution	3.5 gal.
25% Starch Solution in Water	26.5 gal.
Water	27.0 gal.
Lead Naphthenate (24% Lead)	1.5 gal.
Cobalt Naphthenate (6% Cobalt)	0.5 gal.

The procedure described under Formula No. 4 can be followed for the preparation of the above emulsion paint.

Formula No. 7

Titanium Dioxide	200 lb.
Barium Titanium Pigment	200 lb.
Silica	150 lb.
Flake Mica	50 lb.
Alkyd Emulsion (50% Solids)	200 lb.
Water	450 lb.

---

* Octyl alcohol-polyethylene oxide condensation product.

The following emulsion paint has been used satisfactorily for both interior and exterior use.

Formula No. 8

Titanium Dioxide (Non-chalking Type)	100 lb.
Barium Titanium Pigment	100 lb.
Flake Mica	25 lb.
Silica	25 lb.
Alkyd Emulsion (50% Solids)	400 lb.

While linseed oil and ester gum are used in several of the above emulsions, other oils and other resins can be used.

Emulsion paints produced on the above formulae can be reduced with half its volume of water for brush application.

FOOD EMULSIONS

H. Bennett

Emulsifying agents are usually added to food products for one or more of several reasons: to emulsify, to stabilize emulsions, to promote smoothness, or to assist water retention. Naturally, these functions overlap, and the addition of the emulsifier tends to produce all of these effects.

Of course, any emulsifying agent used in foods must itself be edible, and thus we find the most common emulsifiers encountered in this field are the glyceryl monostearates, monolaurates, and monooleates. The corresponding propylene glycol esters are also used, as they are also edible and, through their slight physical variations, are occasionally indicated in special instances.

In the baking industry we find that this type of ester is particularly valuable. For example, in the baking of bread a water-dispersible grade of glyceryl monostearate, when properly used, produces a bread which shows increased retention of *freshness,* maintains softness for a much greater length of time, has improved texture and grain, possesses a more tender crust, and releases its moisture content and flavor slowly, thus enhancing the pleasant, aromatic, *bread* odor and taste.

The general procedure followed may be shown by this typical example:

Into a 150-gal., steam-jacketed, open-head kettle, 84 gal. (700 lb.) of water are introduced and heated to 165° F., or slightly above this temperature. This temperature is maintained while 300 lb. of glyceryl monostearate (water-dispersible) are introduced, with stirring. The water-glyceryl monostearate mixture is then usually transferred to a dough mixer, where stirring is continued until the temperature falls below 100° F. A thick, creamy paste emulsion results.

If no steam-jacketed kettle is available, it is best to add hot water (190° F.) to the cake mixer, immediately add the glyceryl monostearate with stirring, and continue this until the mixture is cool and the stable emulsion is formed.

This 30% dispersion of glyceryl monostearate is then added to the bread in the dough stage (not in the sponge stage) to the extent of about 2 lb. for every 100 lb. of flour used.

Excellent bread is obtained, exhibiting all the desirable characteristics previously mentioned, when only 2% of lard or other shortening is used, plus 2% of the 30% glyceryl monostearate dispersion (percentages are based on the flour used). No other changes in the usual bread formulation are needed; a mere addition of the glyceryl monostearate dispersion is all that is necessary.

It is important, however, that the sponge develop for 4–4½ hours before the glyceryl monostearate dispersion is added. After adding the dispersion, the dough is usually mixed for about 10 minutes, but this varies in individual cases.

In cookies, the usual practice is to use a glyceryl monolaurate of a water-insoluble type as the emulsifying agent. For example, in a vanilla wafer cookie of the *wire cut* type, it is customary to incorporate not more than 1% of this ester, which is a liquid, in the cookie mix. If desired, the shortening content may be reduced by about 25% of that formerly used.

A typical pie formulation, which produces a flakier crust, with better moisture resistance and improved strength, is as follows:

Flour	100
Lard (or Vegetable Shortening or a Combination of Both)	40
Water Dispersion of 40% Glyceryl Monostearate	15
Other Ingredients	As in usual formulation

Edible esters of this type are used in yeast to promote smoothness in the product, and in candy creams and fudges for improved palatability as well. In peanut butter these esters are used to prevent oil separation, in addition to the usual smoothing effect. Many chocolate syrups have these esters as essential quality ingredients.

Mono- and di-glycerides are used in ice-cream to inhibit the growth of large ice crystals and to permit the incorporation of large amounts of air.[1] A smoother, more agreeable product results.[2] In chocolate ice-cream made with gelatin as a stabilizer, the latter reacts with some of the cocoa tannins and loses some of its stabilizing properties. Glyceryl distearate has been patented for this purpose to replace gelatin as a stabilizer. These partial glycerides are incorporated in the form of an aqueous dispersion in the mix just prior to pasteurization. The amount of glyceryl monostearate usually used is about 0.1%, based on the total ice-cream mix.

Mono- and di-glycerides,[3] polyglycerol esters, glycol, hexitol and sugar esters [4] are added to frozen or powdered dried eggs to prevent leakage of water on thawing and to enhance their emulsifying power.

It has been found that 1% of glyceryl monostearate incorporated by means of aqueous dispersion improves fudge to a marked degree as to appearance, lack of drying out, improved cutting, and increased smoothness.

Hydrogenated vegetable oil shortenings, with enhanced emulsifying properties, are prepared by the addition of mono- and di-glycerides.[5] Because these latter contain both fatty acid and free hydroxyl groups they are surface active. They are very useful in aiding dispersion of the shortening base in cake and biscuit-dough mixes. A higher proportion of sugar to flour and other ingredients can be used because of the better dispersion of fat and oil. Better texture, greater volume and slower staling are imparted to cakes made with these products.

---

[1] Bailey, *Oil and Fat Products*, New York, Interscience Publishers, p. 325.

[2] Harris, *Oil & Soap*, **18**, 179 (1941); Mink, Canadian Patent 367,747 (1938); Roth, U. S. Patent 2,065,398 (1936).

[3] Harris, U. S. Patent 2,052,028 (1936); Harris, U. S. Patent 2,142,510 (1939); Newton, Canadian Patent 366,137 (1937); Newton, U. S. Patent 2,182,209 (1939); Swift and Co., French Patent 784,505 (1935).

[4] Harris, U. S. Patent 2,026,631 (1936); Harris, U. S. Patent 2,142,511 (1939); Newton, U. S. Patent 2,182,209 (1939).

Dough mixes containing mono- and di-glycerides are O/W emulsions. The dispersed fat (shortening) particles are surrounded by a continuous watery phase.

INDUSTRIAL WAX EMULSIONS

W. A. Kingman

The application of wax in commercial processes has been greatly extended by the development of wax emulsions specially made for specific purposes. The use of an emulsion of wax instead of a molten wax or a solution in volatile solvents offers many advantages from a practical standpoint. It eliminates any fire risk from volatile solvents. It reduces the cost by obviating the use of expensive solvents. By dilution of the emulsion, it enables the ready application of very thin coatings, as compared with the difficulty of producing thin coatings of molten wax. The wax in emulsion form can be mixed with many aqueous solutions or emulsions of other materials, permitting the application of a composite coating in one operation.

In most cases, the solution or emulsion added to the wax emulsion must be neutral or alkaline to prevent *breaking* of the wax emulsion. By the use of certain special emulsifiers, as

---

[5] Coith, Canadian Patent 359,911 (1936); Coith, Canadian Patent 359,913 (1936); Reynolds, U. S. Patent 2,132,436 (1938); Harris, U. S. Patent 2,132,687 (1938); Procter & Gamble, Brit. Patent 517,319 (1940); Richardson, U. S. Patent 2,132,700 (1938); Richardson, U. S. Patent 2,132,701 (1938); Ellis, U. S. Patent 1,547,571 (1925).

Emulgor A, glue, gum arabic, or Emulsone B, a wax emulsion can be produced which will tolerate the addition of a certain percentage of acid or acid salts without breaking. This enables the production of polish emulsions, containing an acid or acid salt, for metal cleaning and also permits the use, in one emulsion, of waxes and aluminium salts to form waterproof and water-repellent coatings.

Wax emulsions are now used in such a great variety of industries that it is impossible to list all the successful applications.

For the finishing of floors and linoleums, carnauba wax is generally used in conjunction with cheaper waxes and resins. For example, an emulsion of the following type gives very good results as a floor wax.

No. 1 Carnauba Wax	20
A Palm Wax	40
Water-white Linseed Oil Fatty Acids	18
S 489 (Emulsifier)	14
Water	To make 425

In a separate kettle prepare a solution of:

Manila Gum Loba C	30
Water	168
Ammonia (26°)	12

Boil until the gum is dissolved and cool. Add sufficient Manila gum solution to the wax emulsion to obtain the desired waterproofness and gloss. Instead of the Manila gum solution, an alkaline solution of shellac may be used with the wax emulsion.

Other waxes or combinations of waxes may be used but it seems necessary to have a certain proportion of carnauba wax present to produce a satisfactory bright-drying emulsion. Various other emulsifying agents may be used, such as stearic, oleic, lauric, myristic, linoleic or rosin acids combined with an alkali, such as Trigamine, morpholine, triethanolamine, ammonia, caustic potash or soda. In place of Manila gum Loba C, other resins can be used, which can be dissolved in an alkaline solution, the amount to be added to the wax emulsion depending on the gloss and waterproofness desired in the dried film.

In the finishing of leather a top coat is often applied which consists of wax, casein, albumen, plasticizers and other materials. Such a coating is made as follows:

Casein Solution (1 Lb. in 1¼ Gal.)	11	gal.
Soluble Oil	1½	qt.
Dribrite Wax Emulsion (2 Lb. per Gal.)	5½	gal.
Borax-Shellac Solution (2 Lb. per Gal.)	5½	gal.
Alcohol	2	qt.
Irish Moss Solution (1 Lb. in 5 Gal.)	4½	gal.

This gives a colorless, transparent finish. For a white finish, add 170 lb. of Ponolith (lithopone). For the smoothest results, run the mixture through a colloid mill before using.

For rainproofing or rendering fabric water-repellent, an emulsion of paraffin wax with or without aluminium salts is often used. In this case the wax is emulsified by means of glue, gum or other emulsifier which is not affected by acid materials.

In the manufacture of cosmetic creams and lotions, the standard practice has been to make an oil-in-water or a water-in-oil emulsion by means of soap, or a combination of a fatty acid and an alkali. The more modern practice is to avoid the use of harsh alkalies and use a self-emulsifying fat or oil, such as diglycol stearate S, glyceryl laurate S and similar compounds. The partially esterified polyhydroxy alcohol stearates, which may be considered soft waxes, are used in the manufacture of creams, while the laurates, producing more fluid emulsions, may be used to advantage in lotions. The following formula illustrates the possibilities of these emulsifying agents.

Diglycol Stearate	25
Diglycol Laurate	75
Glycerin	50
Sulfatate (Wetting Agent)	10
Cocoa Butter	10
Water	450

Perfume	To suit
Color	To suit

This makes a very smooth lotion which has a good softening effect.

In other cases such waxes as Glyco Wax A, paraffin wax, BZ wax A or beeswax may be added and emulsified by a stearate or a laurate, as mentioned above, to give body and stiffness to a cream which is otherwise too fluid.

For shoe creams or pastes suitable for dispensing in tubes, an emulsion of the waxes desired can be obtained by such emulsifiers as Trigamine stearate, trihydroxyethylamine stearate, or diglycol stearate. The emulsions produced are only very slightly alkaline and consequently safe to use on leather. Such an emulsion is made as follows:

Trigamine Stearate	25
BZ Wax A	10
Candelilla Wax	40
Carnauba Wax	30
Varnolene	20
Water	500

This will give a very light-colored cream. If a colored cream is desired, dissolve sufficient oil-soluble dye in the wax while it is melted.

In the finishing of coated paper, a wax emulsion is often added to the casein top coat. This may be used to increase the waterproofness or, if the paper is to be glazed, the presence of wax in the coating acts as a lubricant during the calendering or flinting and permits the production of a more glossy finish. For such a use, the following wax emulsion may be used.

Laundry Soap	7	lb.
Carnauba Wax	50	lb.
Water	12½	gal.

Boil with live steam till thoroughly emulsified. Cool to 35° C. and add 2 lb. of 26° ammonia. Make up to 50 gal. with cold water. The mixture should be allowed to stand before use, as it seems to improve with age.

For increasing the flexibility of casein-coated boxboard, such as is used in high-grade folding boxes or cartons, an emulsion of Japan wax, stearic acid and borax is sometimes added to the coating mixture to improve the bending and folding properties of the coated cardboard.

Besides the examples mentioned, there are many uses of wax emulsions, such as the coating of fresh fruit, the manufacture of furniture polish, the manufacture of waterproof writing and stamp pad ink, the protection of metal from rusting, and the polishing of small objects by emulsion saturated sawdust in a tumbling barrel.

SYNTHETIC RUBBER LATEX

M. P. Hofmann
C. O. Bartlett & Snow Co.

Probably one of the most commercially important groups of emulsions is that composed of various forms of emulsified or dispersed rubber. This group consists of three general classes: natural latex; reclaimed rubber emulsions; synthetic latex. Of the above, the methods for producing reclaim rubber are well known in the industry, and many interesting and commercially valuable latices are produced from reclaim. These, however, can rarely be substituted for natural latex, mainly because of inferiority of the rubber content.

Natural latex is perhaps one of the most outstanding examples of natural emulsions. The rubber particles are dispersed in various protective colloids, the concentration of rubber being approximately 35%. The particles range in size from 0.5 to 2 microns and are coagulated or agglomerated by evaporation or acidification, depending on the process used or the result desired. Many rubber processes depended entirely on the use and availability of natural latex, and while some of them could not utilize latices made from synthetic rubber, many found these quite as satisfactory as the natural latex.

As natural latex is the root or basic material from which rubber is later made, so, by a coincidence, we find synthetic latex also to be a source material. In the manufacture of synthetic rubber, the reaction stage of the process results in the formation of synthetic latex. The original reaction forms the latex in an ideal emulsion, the rubber particles being from 0.1 to 0.5 micron in size. From this point on, the manufacture of synthetic rubber is divided into two branches, i.e., the utilization of the latex, as such, and the precipitation or coagulation of the rubber from this latex by acidification.

As it is produced in the reaction kettle, the latex has a concentration of about 35% rubber. The pH of this emulsion is in the neighborhood of 8. As the concentration of rubber is increased, the pH must also be raised in order to maintain stability. At a concentration of 50%, the pH should be approximately 9.5. This concentration is produced by vacuum distillation and the pH is naturally reached by the concentration of the latex. However, should it be desired to store or hold this latex for any length of time, or at high temperatures, it is advisable to increase the pH so as to insure stability.

The two most important forms of synthetic latex, namely Buna S and Buna N, differ mainly in their physical characteristics, the Buna S being oil-soluble, softer and more pliable, and lending itself to the manufacture of tires and mechanical goods in which oil solubility is of little importance, while Buna N, a tougher rubber is insoluble in oil and can be used for the manufacture of mechanical goods which require resistance to oil, such as oil and gasoline hose, gaskets, shoes, gloves, etc.

Buna N

Water	10 lb.
Sodium Monobasic Phosphate (or Sodium Borate, or Combinations of Both)	50 g.
Soap (or Aquarex D or Combinations of Both)	226 g.
Sodium Cyanide	6.5 g.

Ethyl Aldehyde	11 g.
Acrylonitrile	2.5 lb.
Butadiene	6 lb.

Any pressure-type, hot-water-jacketed kettle, provided with an agitator and having connections for pressure pump or compressed gas cylinders, is satisfactory for the reaction. A vacuum still is also necessary for the recovery of the unreacted butadiene and styrene.

The soap solution is prepared and all materials except the butadiene gas are placed in the kettle and agitated so as to form an emulsion. The temperature is then raised to approximately 95° F. and the butadiene gas is introduced under a pressure of from 70 to 80 lb., until the required amount has been introduced. The temperature is then brought to 125° F. and held there for the period of time necessary to produce complete reaction. This will be from 15 to 17 hours, after which the batch is finished and may be removed from the kettle. The butadiene at this point will be found to be approximately 75% reacted. The batch is now pumped into a still where the unreacted butadiene is distilled off. This butadiene is later redistilled and fractionated. After removing the unreacted butadiene, from 0.2–0.5% antioxidant (phenyl beta-naphthylamine, or a similar product) based on the amount of rubber in the batch is added. This antioxidant is added in the form of a soap dispersion, prepared by mixing the phenyl beta naphthylamine in a 5% soap solution and passing through a colloid mill. The particle size of the dispersed antioxidant should be between 0.5 and 1 micron.

The ethyl aldehyde in the above is the activator. An increase of this toughens the final rubber to the point where it cannot be milled. Decreasing the ethyl aldehyde increases the tensile strength and plasticity, but also increases the reaction time of the batch.

The rubber from the above latex may be precipitated by the addition of barium chloride and acetic acid.

Buna S

Water	180 lb.
Soap	5 lb.
30% Hydrogen Peroxide	.1 lb.
Styrene	25 lb.
Mercaptan of Amyl or Other Alcohol	0.5 lb.
Butadiene	75 lb.

A hot-water-jacketed kettle provided with agitator and connection for gas cylinders or pressure pump is used.

The soap solution is placed in the kettle and all materials except the butadiene gas are added and agitated until an emulsion is formed. The temperature is then raised to approximately 95° F. and the butadiene gas is introduced under pressure of approximately 80 lb. until the required amount has been added. The temperature is then brought to 125° F. and held there for the required length of time. This is approximately 10 to 12 hours.

The hydrogen peroxide in the above formulae is used as a catalyst and an increase in it will tend to hasten the reaction. This, however, will toughen and harden the rubber to a point where it decreases the tensile strength.

The mercaptan of amyl or other alcohol is used as a modifier and tends to produce long chain reactions. Increase of the same will retard reaction.

The rate of polymerization can be controlled by addition of inert solvents such as benzene, petroleum ether, cyclohexanone, etc.

The above formula will be found to be completely reacted at the end of from 10 to 12 hours. Longer reaction time will tend to decrease tensile strength and plasticity. At the end of the reaction period, approximately 75% of the butadiene and styrene will be reacted and taken up. The batch is then drawn off and pumped into a still where the unreacted styrene and butadiene is distilled off under vacuum at 125° F. The butadiene and styrene are later redistilled and fractionated.

After the removal of the unreacted butadiene and styrene, 0.5

lb. of an antioxidizing agent such as Stabilite, phenyl beta naphthylamine, etc., emulsified as described under Buna N, is added.

If it is desired to precipitate the above latex, it should be creamed by the addition of 2.5 lb. salt dissolved in 10 gal. of water. After this, 1 lb. of glacial acetic acid is added and the resulting precipitate is washed and dried.

EMULSIONS IN LEATHER MANUFACTURING

A. C. ORTHMANN

THERE are three stages in the manufacture of leather where emulsions are applied: stuffing, fat-liquoring, finishing.

Stuffing

In the true sense of the word we cannot call a stuffing compound an emulsion; however, these compounds form emulsions during the stuffing operation.

The following is a typical sole-leather stuffing operation: One thousand pounds of wet leather, containing from 35–50% water, are placed into the hot drum (120° F.) and, while the drum is in motion, the following mixture, heated to 140° F., is added through the hollow axle:

Melted Corn Sugar	20 lb.
Raw Cod Oil	7½ lb.
Mineral Oil	7½ lb.
Sulfonated Cod Oil	7½ lb.

The drum is milled for 30 minutes, after which the leather is removed from the drum and hung up to dry in a dark room. After the leather is dry it is dipped into a hot solution of tanning material, then put into the drum heated to 120° F., and the leather is again stuffed with a mixture, heated to 140° F., containing the following:

Epsom Salts	8 lb.
Melted Corn Sugar	15 lb.
Raw Cod Oil	5 lb.
Mineral Oil	5 lb.
Sulfonated Cod Oil	1 lb.

The drum is milled 30 minutes.

The above formulae are subject to variation as to the amount of each material. The mineral oil usually is a heavy paraffin oil.

The following is a typical stuffing operation for heavy chrome belting leather.

A *stock* stuffing grease is made by melting the following ingredients together:

Tallow	25
Blown Cod Oil (Moellon)	25
Wool Grease	50

Into the drum are placed 500 lb. of the wet leather; the drum is then heated to 150° F. with steam or hot air.

Twelve per cent of the wet weight of the leather (60 lb.) of the hot grease is added, and the drum milled for 30 minutes; then 4% melted corn sugar is added and the drum is milled 15 minutes longer.

The procedure for all stuffing operations is very much the same except that the temperature may vary for chrome-tanned leather as compared to vegetable- or bark-tanned leather. The latter is stuffed at lower temperature.

A stuffing compound for bag-case and strap leather is:

Tallow	20
Paraffin Oil	15
Raw Cod Oil	15
Wool Grease	20
Sulfonated Cod Oil	30

From 5 to 8% of the above compound is used.

Fat-liquoring

THE terms *fat-liquor* and *emulsion* are synonomous in the vernacular of the tanner.

All light leathers, such as calf, kip, kid, and sheepskin, are fat-liquored, and many types of heavy leathers are also fat-liquored, especially those used for the shoe upper and garment.

All types of animal oils, some mineral oils and a number of vegetable oils may be used.

The animals oils and greases are: neatsfoot oil, tallow, wool grease, stearin, fish oils (principally cod), and egg yolk.

Vegetable oils include: cottonseed oil, corn oil, olive oil, castor oil.

The mineral oils include: paraffin oil, petrolatum, paraffin wax.

Emulsifying agents are often added. The principal ones are soap and sulfated oils. Both hard and soft soaps (sodium and potash) are used for the purpose. Sulfated oil may be either of vegetable or animal origin.

The kind of oil and emulsifying agent used depends upon the kind of leather produced. One of the simplest, and probably most used, emulsions for light leathers is made of soap and neatsfoot oil. It is very important that the titer of the oils used is low, that is, that they shall be substantially free from stearic acid.

The soap used for this type of fat-liquor is a *fig* or potash-oil soap. Corn oil is used to a great extent for this purpose. Soaps or oils of high titer have a tendency to cause a *spew* on leather. The *spew* is caused by a deposition of fine crystals of stearic acid on the grain side of the leather. The grain side of the leather will be covered with a film of stearic acid crystals foggy in appearance.

A simple emulsion is prepared as follows:

Raw Neatsfoot Oil (20° F. Cold Test)	1
Potash Corn Oil Soap	1

The soap is dissolved in a minimum of hot water. Then the oil is added and the whole is heated, with continuous agitation to produce an emulsion. The emulsion is placed into the fat-liquoring drum immediately.

A stock emulsion can be prepared and will be stable provided the water content is held at a minimum. The total amount of water should not be less than 1 gal. for each 4 lb. of soap.

The above emulsion is used extensively on kid and calf leather.

Commercial egg yolk is an ideal material for fat-liquoring light leather and it is used on suede kid and calf as well as for all grain leathers.

A typical emulsion of this kind is:

Sulfonated Castor Oil	4
Raw Neatsfoot Oil (20° F.)	2
Egg Yolk	6

Fat-liquors for heavier shoe upper leathers are:

Formula No. 1

Fig Soap	10
Neatsfoot Oil (20° F.)	5
Blown Cod Oil (Moellon)	5
Sulfonated Cod Oil	2
Ammonia	2

Formula No. 2

Sulfonated Cod Oil	6
Sulfonated Neatsfoot Oil	6
Ammonia	2
Raw Neatsfoot Oil (20° F.)	2

Fat-liquors for heavy shoe upper leather, i.e., elk, are:

Formula No. 1

Fig Soap	6
Sulfonated Cod Oil	30
Ammonia	4
Blown Cod Oil (Moellon)	30
Wool Grease	4

Formula No. 2

Borax	6
Blown Cod Oil (Moellon)	24
Wool Grease	4
Sulfonated Cod Oil	16
Sulfonated Neatsfoot Oil	16

Fat-liquors for chrome-tanned split leather are:

Formula No. 1

Fig Soap	20
Paraffin Oil	30
Sulfonated Cod Oil	30

Formula No. 2

Fig Soap	10
Blown Cod Oil (Moellon)	20
Paraffin Oil	30
Sulfonated Cod Oil	40

The above formulae, made up in pounds, give a sufficient amount for 1000 lb. of leather in a condition ready for fat-liquoring.

The materials are compounded in the order given; the final volume is 40–50 gal. The soap or alkali is first boiled with 10–15 gal. of water; the oils are added, and heating and agitation are continued. The source of heat is live steam and a motor stirrer is used. It is customary to use an ordinary open-head barrel. The prepared emulsions are placed into the drum through the hollow axle at a temperature of 120–140° F.

Finishing

The materials used for leather finishing emulsions are waxes, water, and soap. Sulfonated oils are used chiefly as plasticizers.

The most common waxes used are: carnauba, candelilla, beeswax, and Japan wax.

For the preparation of the emulsions a double-jacketed copper kettle is used.

With the better grades of carnauba wax it is possible to make emulsions which are optically clear, and which can be diluted to any degree with distilled water without a trace of turbidity. Such emulsions have been used for finishing leather during the past 25 years. The emulsion is prepared as follows:

Place into the double-jacketed kettle:

North Country Yellow Carnauba Wax	22 lb.
Castile Soap, Dry	6 lb.

Heat, and when the whole mass is melted begin to add hot water in very small portions. The mass must be stirred continuously and water added at such a slow rate that the mass has the consistency of melted petroleum jelly. The final volume should be 22 gal., after the emulsion has cooled.

Other waxes may be emulsified in a similar manner; however, optically clear emulsions are not obtainable with them.

Wax emulsions are not used alone. They form part of a most complex mixture of products, containing shellac, casein, albumin, flax seed, Irish moss or other gums. Stock solutions are made of these products.

There is no definite rule for proportioning the materials in order to obtain a desired result. Everything depends upon the type of leather to be finished and the final appearance desired.

Pigments are also used to a large extent to obtain uniform coloring of the grain surface. These are ground in a *binder* consisting of the various solutions of the above materials.

Leather Finishing Composition

First Finish

Nigrosine	12 oz.
Casein	2 lb.
Blood Albumin	2 lb.
Shellac	2 lb.
Carnauba Wax	1 lb.
Gum Tragacanth	3 oz.
Sulfonated Castor Oil	1 lb.
Ammonia	2 pt.

This is made up to a total of 25 gal. with water. Two coats are applied to the grain surface of the leather. Dry between each application. Then apply one coat of:

Second Finish

Shellac	9 lb.
Blood Albumin	9 lb.
Carnauba Wax	2 lb.
Casein	3 lb.
Nigrosine	12 oz.

This is made up to a total of 35 gal. with water. When the leather is dry apply one coat of:

Top Finish

Shellac	5 lb.
Blood Albumin	2½ lb.
Casein	5 lb.
Nigrosine	½ lb.
Carnauba Wax	1 lb.

This is made up to 25 gal. with water.

PART III

FORMULAS

CHAPTER XIII

AGRICULTURAL SPRAY EMULSIONS

Agricultural Sprays

Formula No. 1[1]

Mineral Oil	2–2½	gal.
Diglycol Oleate	2–3	oz.
Trihydroxyethylamine Linoleate	½–1	lb.
Water	100	gal.

Add in the above order and beat vigorously. The above emulsion is quick breaking and spreads easily.

Formula No. 2[2]

Petroleum Fraction (Sulfonation Value Above 50)	1.2 – 0.3
Trichlorobenzene	0.4 – 0.1
Emulsifying Agent	0.04– 0.01
Water	98.36–99.59

Formula No. 3[3]

Mineral Oil (60–80 Sec.)	95.95
Aluminum Oleate	2.50
Glyceryl Monooleate	1.50
Beta Naphthol	0.05
Water	To suit

Formula No. 4[4]

Anthracene Oil	75
Fish Oil Soap	3
Water	22

Note: If no units are given in the formulae, parts by weight are to be used.

Formula No. 5[5]

Diglycol Laurate	5	qt.
Pyrethrum Extract (20 Fold)	¾	pt.
Water	100	gal.

Formula No. 6[6]

Derris Extract (5%)	1	qt.
Skim Milk Powder	1	lb.
Water	100	gal.

Formula No. 7

Mineral Oil	93
Glyceryl Oleate	2
Nicotine Oleate	5

Formula No. 8[7]

Into about 2 gal. of cold water, 0.84 lb. of casein is slowly poured and stirred until thoroughly wet and soaked; 0.63 lb. of dehydrated sodium carbonate is added, with stirring until all the casein is well in solution. Six gallons of denatured alcohol and 1.67 lb. of powdered gamboge are then added. The gamboge is added slowly, with constant stirring. Enough water is added to make up a total of 20 gal. The oil to be emulsified is incorporated, preferably by slow additions with agitation. Most oils will emulsify readily. Heat may be applied if quicker emulsification is desired. For petroleum oil, for example, with a specific gravity of 0.891, a proportion of 1 part by volume of this composition to 5 parts of the oil affords a satisfactory product. Such an emulsion will contain about 83.3% of oil, making up to a consistency about that of lard at the same temperature. Such a product does not separate even after standing in a warm place for months.

Formula No. 9[8]

Mineral Oil	91.4
Glyceryl Oleate	1.5
Aluminum Oleate	2.0

Nicotine	2.0
Naphthenic Acid	3.1

Add water before use.

Mildew Spray

Linseed Oil	12 fl. oz.
Liver of Sulfur	2 lb.
Cresol	3 lb.
Caustic Potash, Commercial	1 lb.
Water	To make 1 gal.

Fruit Tree Sprays

Formula No. 1 [9]

Olein	20
Coal Tar Oil	70
Caustic Potash (24° Bé.)	19

Formula No. 2 [10]

Tall Oil, Crude	22
Coal Tar Oil	70
Caustic Soda (36° Bé.)	9

Formula No. 3 [11]

Tall Oil Distillate	22
Coal Tar Oil	68
Caustic Potash (36° Bé.)	12.5

Formula No. 4 [12]

Woolfat Fatty Acid, Crude	25
Coal Tar Oil	65
Caustic Potash (36° Bé.)	12

Formula No. 5 [18]

Olein	20
Coal Tar Oil	65
Caustic Soda (36° Bé.)	9
Methyl Hexalin	5

Formula No. 6[14]

Tall Oil, Crude	20
Coal Tar Oil	62
Caustic Soda (24° Bé.)	15
Alcohol, Denatured	3

Formula No. 7[15]

Olein	5
Colophony	15
Coal Tar Oil	70
Caustic Soda (36° Bé.)	9

Formula No. 8[16]

Tall Oil, Crude	10
Colophony	10
Coal Tar Oil	65
Caustic Soda (24° Bé.)	15

Formula No. 9[17]

Tall Oil, Crude	15
Woolfat Fatty Acid	10
Coal Tar Oil	70
Caustic Soda (24° Bé.)	11.5

Formula No. 10[18]

Tall Oil, Crude	10
Woolfat Fatty Acid	10
Coal Tar Oil	70
Caustic Soda (36° Bé.)	8

Formula No. 11[19]

Colophony	20
Crude Montan Wax	5
Coal Tar Oil	60
Caustic Potash (40° Bé.)	12

Use iron or enameled kettles which are steamheated, or fired from below, and which can be emptied at the bottom.

Heat 50% of the coal tar oils (or their blends) with the saponifiable materials (colophony, olein, tall oil, montan wax, woolfat fatty acid, etc.) to about 80°C.

Thin the saponification lye with 50–100% of water in a separate kettle; low-degree lyes are diluted more than high-degree lyes.

Stir the thinned caustics into the hot oils. Boil. The saponification starts when the content of the kettle starts "rising."

Stir continuously; watch the heating in order to prevent the kettle boiling over.

As soon as the saponification is finished, add the remainder of the coal tar oil, previously heated separately to 70°C.

When all is well mixed, boil for a second time until the material is nearly clear. Too much water in the preparation makes it cloudy. In such a case boil further.

Test by cooling a sample, which should be clear and show the right, well-bound consistency. If the cooled sample is gelatinous, water should be added.[20]

Formula No. 12[21]

Coal Tar Oil (Carbolineum)	60
Tall Oil	25
Ammonia (Sp. Gr. 0.96)	15
Water	10

Saponify at about 40–50°C. This should emulsify readily with 10 times the amount of water.

Formula No. 13[22]

Tall Oil	300
Caustic Soda (20° Bé.)	280–290
Tar Oil (Middle Fraction)	1,200
Crude Mineral Oil	200

Formula No. 14[23]

Nicotine Sulfate (40%)	1	pt.
Bentonite	5	lb.
Soybean Oil	1	qt.
Sodium Lauryl Sulfate	½	oz.
Water	100	gal.

Formula No. 15[24]

Cottonseed Oil	6	pt.
Copper Sulfate (10% Solution)	4½	gal.
Hydrated Lime	6	lb.
Water	100	gal.

Formula No. 16[26]

Caustic Soda	1.3
Naphthenic Acid	10–12
Mineral Oil	50–72

Dilute and mix with water as needed.

Formula No. 17[27]

Copal Oil	500
Water	2000
Morpholine	20
Oleic Acid	45

Add the oleic acid to the copal oil, with stirring. Add the morpholine, still using high-speed stirring. Add the water slowly, stirring during addition of water.

This copal emulsion when sprayed on Japanese beetles will prevent them from flying and kill them slowly.

Insecticide Sprays

Formula No. 1[30]

Arachis Oil	2.00 l.
Oleic Acid	0.75 l.
Ammonia	0.50 l.
Water	100.00 l.

The oil is mixed with the oleic acid. The ammonia is added to 2 l. of water. The oil mixture is added to the ammonia solution slowly with high-speed agitation.

Before use, add the remaining water.

Formula No. 2[31]

Cottonseed Oil	1 gal.
Paradichlorobenzene	2 lb.
Potash-Fish Oil Soap	1 pt.
Water	To make 2 gal.

Dissolve 2 lb. of paradichlorobenzene crystals in 1 gal. of cottonseed oil. To do this in cool weather, heat the oil to about 90°F. before adding the chemical. Stir the oil until the crystals entirely dissolve before proceeding further. Stir the resultant mixture into 1 pt. of potash-fish oil soap and then stir in enough water to make 2 gal. This stock emulsion may be stored for several days in a sealed drum. Each gallon of the stock emulsion should be diluted with 3 gal. of water immediately before using.

Formula No. 3[32]

A 5% petroleum emulsion (made by adding 0.5 l. petroleum to 1 kg. laundry soap dissolved in 10 l. boiling water) is recommended against thrips.

Formula No. 4[33]

Pyrethrum Extract	1 qt.
Kerosene	6 gal.
Neutral Soap	4 lb.
Water	94 gal.

Formula No. 5[34]

White Mineral Oil (Visc. 80–85)	85
Triamylamine	3
Monoamylamine Oleate	10

One part of above mixture is diluted with 200–400 parts of water.

Formula No. 6[35]

Glyceryl Oleate	2
Oil-soluble Nicotine Compound	5

White Mineral Oil	93
Water	To suit

Formula No. 7[36]

Glyceryl Oleate	1.5
Aluminum Oleate	2.0
Nicotine	2.0
Naphthenic Acid	3.1
White Mineral Oil	91.4
Water	To suit

Formula No. 8[37]

Gum Ghatti	2.4
Cresylic Acid	0.18
Water	35
White Oil (80 Sec. Saybolt at 100° F.)	62.4
1,4-Toluido Anthraquinone	0.02

The concentrated emulsion may be prepared by mixing the ingredients in a colloid mill, or by passing the mixture through a centrifugal pump, or in any other suitable manner to give a concentrated composition which may be diluted to yield an emulsion suitable for spraying purposes.

Formula No. 9[38]

Nicotine Sulfate (40%)	1	pt.
Bentonite	5	lb.
Soybean Oil	1	qt.
Wetting Agent (Wetanol)	½	oz.
Water	100	gal.

Mix well until emulsified.

Formula No. 10[39]

Diglycol Oleate	2
Pyrethrum Extract (Mineral Oil or Kerosene)	50

Mixing the above together gives a concentrated spray base free from alkalies. The active principle of pyrethrum is thus unaffected. Burning due to alkali is also eliminated.

The above concentrate emulsifies readily on stirring in water with a pump. It is quick-breaking when sprayed on foliage.

Formula No. 11[40]

Pyrethrum Extract, 15%	100
Turkey Red Oil, Neutral	500

Apply in 0.5–1% aqueous dilution.

Formula No. 12[41]

One g. of pure rotenone is dissolved in 100 cc. pyridine. One cc. of this solution is added to 100 cc. distilled water and shaken gently. A pale opalescent colloidal solution results, which shows no evidence of separation over an extended period of time.

Formula No. 13[42]

Five g. of pure rotenone are dissolved in 100 cc. pyridine. One cc. of this solution is added to 100 cc. distilled water and shaken gently. A deeply opalescent colloidal solution results, which shows no evidence of separation over an extended period of time.

Formula No. 14[43]

In 100 cc. α-picoline 1.2 g. of pure rotenone are dissolved. One cc. of this solution is added to 100 cc. distilled water and shaken gently. A colloidal solution of medium opalescence results, which shows no evidence of separation during a considerable period of time.

Formula No. 15[44]

Water	5 cc.
Caustic Potash	7.4 g.
Pine Tar Oil	44.3 cc.
Cellosolve	10 cc.
Oleic Acid	33.3 cc.

Mix in the order given.

Formula No. 16[45]

Water	5.00
Potassium Hydroxide (92% Flaked)	7.40
Pine Tar Oil (Sp. Gr. 1.035)	44.30
Ethylene Glycol Monoethyl Ether	10.00
Oleic Acid	33.30

Mix in the order given.

Formula No. 17[46]

Soap	8 oz.
Pine Tar Oil (Sp. Gr. 1.065)	6 oz.
Water	1 gal.

Boil the soap and water; while mixing vigorously, add slowly the pine tar oil.

Formula No. 18[47]

Kerosene	90
Oleic Acid	8
Triethanolamine	3
Water	100

This is made into a primary emulsion which may be diluted with 1 or 2 gal. of water for washing infested animals.

Formula No. 19[48]

Naphthalene	1
Kerosene	4
Cyclohexanol	2
Creosote	1

Dissolve by mixing and add slowly with vigorous stirring

Liquid Soap	32
Water	120

Formula No. 20
(Mosquito Larvicide)

Fuel Oil No. 2	6 gal.

Sulfated Sperm Oil	1 qt.
Water	30–40 gal.

This will treat effectively 1 acre of water surface.

Formula No. 21
(Mosquito Larvicide)

Diesel Fuel Oil	1
Sulfated Sperm Oil	4
Water	95

Formula No. 22
(DDT Emulsion Insecticide Spray)

DDT	100 g.
Benzol	140 cc.
Dibutyl Phthalate	140 cc.
Triton NE	12 g.
Water	1 l.

Formula No. 23
(Concentrate)

Xylol	65
DDT	25
Diglycol Laurate S	10

Formula No. 24
(Coddling Moth Spray)

DDT	4 lb.
Pyrophyllite	4 lb.
Water	100 gal.

Emulsifiers and Spreaders for Insecticides[49]

The following formulae, which do not include water, are emulsion bases. These bases form emulsions on mixing with water solutions.

Formula No. 1

An emulsifier, which can be added to various insecticide liquids as required, contains: 48.6 parts oleic acid, 5.7 parts phenol, 17.1 parts isoamyl alcohol, 8.6 parts ethylene glycol monoethyl ether, 20 parts of 50% solution caustic potash.

Amyl alcohol can be substituted for isoamyl alcohol, but the emulsifier is somewhat less stable; substitution of pine distillates requires special precautions.

Formula No. 2

An emulsifier for miscible mixtures is: 32.5 parts oleic acid, 32.5 parts cresol U.S.P., 10 parts Yarmor pine oil, 15.0 parts of 50% solution caustic potash, and 10 parts kerosene.

Fifteen per cent of this emulsifier forms a miscible mixture which is stable on dilution with water. Phenol cannot be substituted for cresol in this formula.

Formula No. 3

A combined spreader and emulsifier contains: 25.0 parts oleic acid (high saponification number), 15.0 parts cresol U.S.P., 20.0 parts of 50% solution caustic potash, 5 parts kerosene.

This has high emulsifying and spreading powers. In some instances α-terpineol can be substituted for Yarmor pine oil, and London resin and pine tar oil (sp. gr. 1.035) for cresol. The formulae may be used with many but not all insecticide liquids; modifications are sometimes necessary.

Fruit Coating Wax Emulsions

Formula No. 1 [51]

Caustic Soda	6
Triethanolamine	20
Stearic Acid	42
Paraffin Wax	165
Carnauba Wax	55
Shellac	100
Water	2000

Dilute before use.

Formula No. 2[52]

Paraffin Wax	553
Carñauba Wax	68
Cottonseed Oil	98
Oleic Acid	183
Triethanolamine	98
Water (Containing Soda Ash)	To suit

Formula No. 3[53]

Paraffin Wax	168.0
Beeswax	42.0
Oleic Acid	22.0
Sodium Bicarbonate	6.6
Salt	2.2
Water	599.2

These emulsions will readily coat fruits and vegetables with non-waxy surfaces, but spreading agents are necessary when they are used for waxy fruits. Alkyl naphthalene sulfonates are suitable spreading agents and also inhibit breaking of the emulsions.

Sheep Dips

Formula No. 1[54]

Hydrocarbons	46.78
Pyridine	2.36
Cresylic Acid	21.67
Rosin	5.39
Soap	18.10
Water	5.70

Formula No. 2[55]

Tar Oil	39.30
Paraffin Oil	31.00
Lanolin	5.00
Crude Cresylic Acid	3.70
Soft Soap	21.00

The tar oil used is that oil distilling between 180° to 220°C. and containing 20.25% phenol. All the materials are mixed together in a boiler and gradually heated until all the soap and lanolin have dissolved, and then boiled gently for a short time, cooled and packaged.

Formula No. 3[56]

Tar Oil	41.80
Paraffin Oil	33.50
Crude Cresylic Acid	3.70
Soft Soap	21.00

Prepare in the same manner as the previous dip.

REFERENCES

[1] Bennett, Chem. Formulary, Vol. 1, p. 215 (1933).
[2] U. S. 2,046,901.
[3] Sharp, U. S. 2,240,806 (1941).
[4] Bennett, Chem. Formulary, Vol. 1, p. 215 (1933).
[5] Bennett, Chem. Formulary, Vol. 3, p. 119 (1936).
[6] Bennett, Chem. Formulary, Vol. 3, p. 119 (1936).
[7] Bennett, Chem. Formulary, Vol. 1, p. 216 (1933).
[8] Bennett, Chem. Formulary, Vol. 5, p. 76 (1941).
[9] Bennett, Chem. Formulary, Vol. 5, p. 75 (1941).
[10] Bennett, Chem. Formulary, Vol. 5, p. 75 (1941).
[11] Bennett, Chem. Formulary, Vol. 5, p. 75 (1941).
[12] Bennett, Chem. Formulary, Vol. 5, p. 75 (1941).
[13] Bennett, Chem. Formulary, Vol. 5, p. 75 (1941).
[14] Bennett, Chem. Formulary, Vol. 5, p. 75 (1941).
[15] Bennett, Chem. Formulary, Vol. 5, p. 75 (1941).
[16] Bennett, Chem. Formulary, Vol. 5, p. 75 (1941).
[17] Bennett, Chem. Formulary, Vol. 5, p. 75 (1941).
[18] Bennett, Chem. Formulary, Vol. 5, p. 75 (1941).
[19] Bennett, Chem. Formulary, Vol. 5, p. 75 (1941).
[20] Bennett, Chem. Formulary, Vol. 5, p. 75 (1941).
[21] Bennett, Chem. Formulary, Vol. 5, p. 75 (1941).
[22] Bennett, Chem. Formulary, Vol. 5, p. 75 (1941).
[23] Bennett, Chem. Formulary, Vol. 5, p. 75 (1941).
[24] Bennett, Chem. Formulary, Vol. 5, pp. 75–76 (1941).
[25] Bennett, Chem. Formulary, Vol. 5, pp. 75–76 (1941).
[26] U. S. 2,000,843.
[27] Bennett, Chem. Formulary, Vol. 5, p. 101 (1941).
[28] Bennett, Chem. Formulary, Vol. 5, p. 76 (1941).
[29] Bennett, Chem. Formulary, Vol. 5, p. 76 (1941).
[30] Bennett, Chem. Formulary, Vol. 5, p. 101 (1941).

[31] Bennett, Chem. Formulary, Vol. 5, p. 90 (1941).
[32] Bennett, Chem. Formulary, Vol. 5, p. 76 (1941).
[33] Bennett, Chem. Formulary, Vol. 3, p. 119 (1936).
[34] Bennett, Chem. Formulary, Vol. 5, p. 76 (1941).
[35] Adams, U. S. 2,258,833 (1941).
[36] Adams, U. S. 2,258,833 (1941).
[37] Bennett, Chem. Formulary, Vol. 3, p. 119 (1936).
[38] Bennett, Chem. Formulary, Vol. 5, p. 76 (1941).
[39] Bennett, Chem. Formulary, Vol. 1, p. 215 (1933).
[40] Bennett, Chem. Formulary, Vol. 4, p. 107 (1939).
[41] Bennett, Chem. Formulary, Vol. 2, p. 272 (1935).
[42] Bennett, Chem. Formulary, Vol. 2, p. 273 (1935).
[43] Bennett, Chem. Formulary, Vol. 2, p. 273 (1935).
[44] Bennett, Chem. Formulary, Vol. 3, p. 118 (1936).
[45] Bennett, Chem. Formulary, Vol. 4, p. 105 (1939).
[46] Personal Communication.
[47] Bennett, Chem. Formulary, Vol. 4, p. 115 (1939).
[48] Bennett, Chem. Formulary, Vol. 4, p. 104 (1939).
[49] Bennett, Chem. Formulary, Vol. 5, p. 76 (1941).
[50] Bennett, Chem. Formulary, Vol. 5, p. 76 (1941).
[51] U. S. 2,153,487.
[52] MacRill, U. S. 2,019,758 (1935).
[53] Trout, J. Coun. Sci. Ind. Research *15,* 26 (1942).
[54] Bennett, Chem. Formulary, Vol. 5, p. 112 (1941).
[55] Bennett, Chem. Formulary, Vol. 5, p. 113 (1941).
[56] Bennett, Chem. Formulary, Vol. 5, p. 113 (1941).

CHAPTER XIV

CUTTING OILS, "SOLUBLE" OILS, MISCIBLE OILS

Formula No. 1[1]

Sodium Corn Oil Soap	14
Water	6
Mineral Oil	64
Water White Rosin	10
Carbitol	2
Diethylene Glycol	4

This oil is clear and will not become cloudy when cooled to a temperature of 60°F. It will not become covered with a film after standing exposed to the air at a temperature of 80°F. over a long period of time or at a temperature of 200°F. for one day. It will readily emulsify with water after standing exposed to the air at 200°F. for two days.

Aqueous emulsions containing this oil are very stable even at a temperature of 200°F. In general, stable aqueous emulsions are prepared by using 1–35% of this oil, although they can also be prepared with proportions of the oil outside these limits.

Formula No. 2[2]

Kerosene	60
Sulfonated Castor Oil	20
Alcohol	1
Sulfonated Coconut Oil (Neutralized with Rosin Soap)	20

This forms an emulsion when mixed with water.

Formula No. 3[3]

Oleic Acid	15
Rosin	15
Kerosene	10
Trigamine	20

Melt the oleic acid at 85°C. with high speed stirring. Add the trigamine and continue stirring. Then turn off the heat and add the kerosene slowly, with stirring. This gives a clear transparent liquid which emulsifies readily in water.

Formula No. 4[4]

Mineral Oil	4
Aerosol OT (100%)	1
Glycostearin	1
Water	100

Heat together to 100–120°C.; cool to 80°C. and add slowly, with stirring, to the water (heated to 80°C.).

Formula No. 5[5]

Rosin	15
Red Oil	15
Mineral Oil	10
Potassium Hydroxide (45%)	5
Isopropyl Alcohol	10
Wetanol or Other Wetting Agent	1/16

Warm together and mix until uniform.

Formula No. 6[6]

a. Mineral Oil (Spindle Oil)	80
Tall Oil, Refined	20
b. Caustic Potash (40° Bé.)	6
c. Methylhexalin	1–2

Saponify *a* with *b*, clear with *c*.

Formula No. 7[7]

Mineral Oil	71 –74
Castor Oil	8¼– 9½
Rapeseed Oil	8¼– 9½
Caustic Potash	8¼– 9½
Soda Ash	0.6 – 1¼

Mix and dilute with water.

Formula No. 8[8]

Mineral Oil	75
Naphthenic Acid Sludge	25

Formula No. 9[9]

Mineral Oil	75
Naphthenic Soap	25

Formula No. 10[10]

Mineral Oil	32
Oleic Acid	10
Alcohol	3
Trigamine	5

The above are thoroughly mixed cold and form a clear transparent oil which readily emulsifies when poured into water with slight stirring.

Formula No. 11[11]

Light Mineral Oil	65
Sulfonated Cod Oil	27
Olein	10
Water	5
Caustic Soda	2
Cresol	1

Formula No. 12[12]

Alcohol, Denatured	15
Diglycol Laurate	85
Mineral Oil	400

Formula No. 13 [13]

Pine Oil	75
Carbitol	25
Sulfatate (or Other Water-soluble Sulfonic-Acid Esters or Salts)	20
Water	20
Diglycol Laurate	360
Mineral Oil	1600

The Sulfatate is dissolved in water and mixed well into the other ingredients. This oil disperses in hard waters without scum formation.

Formula No. 14 [14]

Sulfonated Castor Oil	15
Carbitol	5
Diglycol Laurate	80
Mineral Oil	410

Formula No. 15 [14a]

Sodium Abietate	10
Pine Oil	10
Mineral Oil	40

Mix the sodium abietate and pine oil and then add the mineral oil.

Formula No. 16 [15]

Sodium Abietate	31
Rosin Oil	10
Denatured Alcohol	4
Mineral Oil	159

The mixture of above oils gives rich creamy emulsions with water.

Formula No. 17 [16]

Oleic Acid	10
Mineral Oil	32

Trigamine	5
Alcohol	3

Formula No. 18 [17]

Rosin	20
Petronate	100
Diethylene Glycol	20
Mineral Oil	840

Formula No. 19 [18]

Olein or Wool Grease	12.25
Animal or Vegetable Oil	7.50
Mineral Oil	2.45
Caustic Soda Solution	77.80

Formula No. 20 [18a]

Paraffin Oil	48 fl. oz.
Water	34 fl. oz.
Red Oil	15 fl. oz.
Sodium Hydroxide	1.8 oz.

The sodium hydroxide is dissolved in the water and the red oil and paraffin oil which have been previously mixed are run in, while stirring rapidly. This forms a white milky preparation.

Formula No. 21 [19]

Paraffin Oil (28° Bé.)	33
Sulfonated Castor Oil (75%)	33
Sulfonated Red Oil (75%)	33

Mix at 40°C.

Formula No. 22 [20]

Paraffin Oil (28 to 30° Bé.)	250
Rosin	22
Oleic Acid	22
Caustic Soda	3
Water	10
Alcohol	7

Formula No. 23 [21]

Potash Soap	30
Olein	7
Cyclohexanol	2
Paraffin Oil	32

Formula No. 24 [22]

Sodium Naphthenic Sulfonate	12.00
Naphthenic Acid	3.00
Sodium Hydroxide	0.50
Alcohol	0.50
Water	2.00
Montan Wax	0.05
Paraffin Oil	81.95

Formula No. 25 [22]

Sodium Naphthenic Sulfonate	12.00
Rosin	4.60
Sodium Hydroxide	0.50
Alcohol	0.50
Water	2.00
Montan Wax	0.05
Paraffin Oil	80.35

Formula No. 26 [23]

Pine Oil	2.5
Red Oil	12.0
Caustic Potash (50%)	4.0
Alcohol, Anhydrous	5.0
Potassium Oleo-Abietate	16.0

Formula No. 27 [23a]

Pine Oil	80
Double Sulfonated Castor Oil	20

Formula No. 28 [24]

Pine Oil	12
Red Oil	9
Carbitol	8

Diglycol Laurate	65
Sulfatate (or Other Water-soluble Sulfonated Hydrocarbon)	6

Formula No. 29[25]

Miscibol	16.0
Oleic Acid	12.0
Caustic Potash (45%)	3.0
Isopropanol	5.0
Pine Oil	2.5

Formula No. 30[26]

Sodium Abietate	25
Oleic Acid	10
Pine Oil	4
Isopropanol	6

Formula No. 31[27]

Steam-distilled Pine Oil	50
Sulfonated Castor Oil (75%)	50
Caustic Soda (27° Bé.)	10
Water	40

Heat the pine oil to 38°C. in a lead-lined tank, add the sulfonated castor oil, then add the caustic soda gradually with agitation, maintaining the temperature noted above. When a nearly clear solution is obtained, add the water slowly, continuing agitation, then allow to cool rapidly.

Formula No. 32[28]

a. Soya Oil Fatty Acid or Linseed Oil Fatty Acid	25
b. Pine Oil	35
c. Water	10
d. Caustic Potash (50° Bé.)	10
e. Pine Oil	160

Mix *a* and *b*, and warm gently with *c*, *d* and *e*.

Formula No. 33[29]

Spindle Oil, Refined 4–5 E. (20°C.)	50.0
Oleic Acid, Distilled	20.0

Sodium Hydroxide (29° Bé.)	About 12.5
Alcohol, to make clear	About 12.5

Formula No. 34 [30]

Spindle Oil	100.0
Oleic Acid	12.0
Butanol	7.0
Triethanolamine	0.5
Caustic Potash (38° Bé.)	4.5

Heat the oils to about 70°C., add the butanol and the triethanolamine. Add the caustic potash and leave standing hot to clarify.

Formula No. 35 [31]

Tall Oil, Refined	20
Spindle Oil, Refined	72
Caustic Soda (38° Bé.)	8
Alcohol	To clear
Fatty Acid	A little, to clear

Formula No. 36 [32]

Naphthenesulfonic Acids	15
Olein (or Liquid Wool Fatty Acid)	5–7
Spindle Oil, Refined (60°C.)	75
Caustic Potash (25° Bé.)	Until neutral
Hexalin and Tetralin (1:1)	3–4

Formula No. 37 [33]

Rosin Soap	25
Red Oil	10
Pine Oil	4
Alcohol, Anhydrous	6

Formula No. 38 [34]

Olein	16
Spindle Oil, Refined	73
Caustic Soda (36° Bé.)	6
Alcohol, Denatured	5

Formula No. 39[35]

Olein	20
Spindle Oil, Refined	72
Caustic Potash (40° Bé.)	8

Formula No. 40[36]

Tall Oil, Refined	20
Spindle Oil, Refined	70
Caustic Potash (36° Bé.)	10

Formula No. 41[37]

Tall Oil, Refined	20
Spindle Oil, Refined	72
Caustic Soda (36° Bé.)	8

Formula No. 42[38]

Train Oil Fatty Acid	20
Spindle Oil, Refined	70
Caustic Potash (40° Bé.)	7
Hexalin	3

Formula No. 43[39]

Naphthenic or Hydroxy Fatty Acid	12
Spindle Oil, Refined	80
Caustic Soda (36° Bé.)	6
Benzoline	2

Formula No. 44[40]

Colophony (Rosin)	8
Olein	6
Spindle Oil, Refined	78
Caustic Soda (24° Bé.)	8

Formula No. 45[41]

Turkey Red Oil	15
Olein	10
Spindle Oil, Refined	65
Caustic Potash (40° Bé.)	10

Formula No. 46[42]

Bone Fat Fatty Acid	20
Olein	5
Spindle Oil, Refined	63
Caustic Soda (24° Bé.)	12

Formula No. 47[43]

Lanolin Fatty Acids	16
Spindle Oil, Refined	75
Caustic Potash (24° Bé.)	9

Formula No. 48[44]

Woolfat Fatty Acids	7
Lanolin Fatty Acids	8
Spindle Oil, Refined	77
Caustic Soda (24° Bé.)	8

Formula No. 49[45]

Olein	18
Spindle Oil, Refined	45
Caustic Potash (40° Bé.)	7
Water	30

The amount of caustic must be varied since the saponifiable materials are not constant in acidity.

Formula No. 50[46]

Glyceryl Monostearate	75
Sperm Oil	150
Sodium Salt of Sulfonated Oleyl Alcohol	50
Water	1200

Warm and mix vigorously.

Formula No. 51[47]

Sulfonated Oil	11.5
Soap	17.5
Cottonseed Oil	8.5
Oleic Acid	10.5

Mineral Oil	2.0
Water	50.0

Formula No. 52[48]

Carbitol	5
Diglycol Laurate	95
Orthodichlorbenzol	400

Formula No. 53[49]

Sulfonated Castor Oil	70
Turpentine	10
Tetrahydronaphthalene	15
Pine Needle Oil	5

Formula No. 54[49]

Tetralin	15
Turpentine	10
Pine Needle Oil	5
Sulfonated Vegetable Oil	70

Formula No. 55[50]

Sal Soda	¼ lb.
Lard Oil	½ pt.
Soft Soap	½ pt.
Water	To make 10 qt.

Boil the above ingredients for one-half hour and place in suitable containers.

Metal-drawing Compounds

Formula No. 1[51]

Lard Oil, Prime	40 lb.
Diglycol Laurate	10 lb.
Water	50 gal.

Formula No. 2[52]

Soap, Neutral	10 lb.
Diglycol Laurate	7 lb.
Lard Oil, Prime	13 lb.

Mineral Oil	20 lb.
Water	200 gal.

Warm, together, the first four ingredients until clear and pour into water slowly; mix well. In certain cases it is desirable to add

White Lead	3 lb.

Formula No. 3[53]

Diglycol Stearate	6
Glycowax A	2
Water	56

Formula No. 4[54]

Sodium Alginate	1
Tallow	4
Soap	2
Water	195

Formula No. 5[55]

Tallow	3.0
Rape Seed Oil	1.5
Soap	0.5
Water	95.0

Warm together and emulsify. In using, maintain pH at 8–9.

Formula No. 6[56]

Soluble Alginate	1
Tallow	4
Soap	2
Water	195

Formula No. 7[57]

Tallow	60 lb.
Yellow Soap	15 lb.
Water	92 gal

Heat and stir until smooth.

Formula No. 8[58]

Sulfated Higher Fatty Alcohol	3
Tallow	20
Water	20

Naphthenic Miscible Oils[59]

Formula No.	1	2	3	4	5	6	7	8	9	10
a. Potassium Naphthenate From—										
Heavy Gas Oil	65	48								
Light Lube Oil			37	37	37	23	20	30		
Heavy Lube Oil									13	30
b. Light Lube Oil	20	35	50	45	50	58	62	55	69	64
c. Common Solvents										
Group 1: Water-soluble										
Ethylene Glycol										3
Diethylene Glycol	5	5	5	5	5	5	5	5	5	
Group 2: Oil-soluble										
Sub-group A										
Pine Oil		10		10						
Alpha Terpineol	5		5			5	5	10	5	
Octyl Alcohol					5					
Sub-group B										
Rosin	5					5			5	3
Cresylic Acid							5			
d. Water		2	3	3	3	4	3		3	

REFERENCES

[1] U. S. 1,965,935.
[2] U. S. 2,021,448.
[3] Bennett, Chem. Formulary, Vol. 4, p. 207 (1939).
[4] Personal Communication.
[5] Bennett, Chem. Formulary, Vol. 4, p. 207 (1939).
[6] Bennett, Chem. Formulary, Vol. 3, p. 210 (1936).
[7] Bennett, Chem. Formulary, Vol. 3, p. 210 (1936).
[8] Bennett, Chem. Formulary, Vol. 4, p. 187 (1939).
[9] Bennett, Chem. Formulary, Vol. 4, p. 187 (1939).
[10] Bennett, Chem. Formulary, Vol. 4, p. 187 (1939).
[11] Bennett, Chem. Formulary, Vol. 4, p. 207 (1939).
[12] Bennett, Chem. Formulary, Vol. 4, p. 187 (1939).
[13] Bennett, Chem. Formulary, Vol. 4, p. 95 (1939).
[14] Bennett, Chem. Formulary, Vol. 4, p. 95 (1939).
[14a] Bennett, Chem. Formulary, Vol. 1, p. 428 (1933).
[15] Bennett, Chem. Formulary, Vol. 1, p. 428 (1933).

[16] Bennett, Chem. Formulary, Vol. 4, p. 187 (1939).
[17] L. Sonnenborn Sons, N. Y. C.
[18] Erbs, Fr. 484,382 (1917).
[18a] Personal Communication.
[19] Personal Communication.
[20] Bennett, Chem. Formulary, Vol. 3, p. 210 (1936).
[21] Bennett, Chem. Formulary, Vol. 2, p. 303 (1935).
[22] Zimmer, U. S. 2,230,556 (1941).
[23] Bennett, Chem. Formulary, Vol. 4, p. 96 (1939).
[redacted]
a Personal Communication.
ennett, Chem. Formulary, Vol. 4, p. 95 (1939).
rsonal Communication.
sonal Communication.
nal Communication.
, Chem. Formulary, Vol. 3, p. 325 (1936).
Chem. Formulary, Vol. 4, p. 187 (1939).
hem. Formulary, Vol. 4, p. 187 (1939).
[31] m. Formulary, Vol. 4, p. 207 (1939).
[32] B . Formulary, Vol. 3, p. 213 (1936).
[33] Ben Formulary, Vol. 4, p. 95 (1939).
[34] Benn Formulary, Vol. 4, p. 206 (1939).
[35] Bennett, rmulary, Vol. 4, p. 206 (1939).
[36] Bennett, mulary, Vol. 4, p. 206 (1939).
[37] Bennett, C ulary, Vol. 4, p. 206 (1939).
[38] Bennett, Ch lary, Vol. 4, p. 206 (1939).
[39] Bennett, Che ry, Vol. 4, p. 206 (1939).
[40] Bennett, Chem y, Vol. 4, p. 206 (1939).
[41] Bennett, Chem. Vol. 4, p. 206 (1939).
[42] Bennett, Chem. F Vol. 4, p. 206 (1939).
[43] Bennett, Chem. Fo ol. 4, p. 206 (1939).
[44] Bennett, Chem. For . 4, p. 206 (1939).
[45] Bennett, Chem. Form 4, p. 206 (1939).
[46] Bennett, Chem. Formu p. 207 (1939).
[47] Bennett, Chem. Formula . 207 (1939).
[48] Bennett, Chem. Formulary 95 (1939).
[49] Muncheburg, Fr. 674,816 (
[50] Bennett, Chem. Formulary, V (1935).
[51] Bennett, Chem. Formulary, Vol 939).
[52] Bennett, Chem. Formulary, Vol. 39).
[53] Bennett, Chem. Formulary, Vol. 4,).
[54] Bennett, Chem. Formulary, Vol. 3, p.
[55] Bennett, Chem. Formulary, Vol. 4, p.
[56] Bennett, Chem. Formulary, Vol. 2, p. 300
[57] Bennett, Chem. Formulary, Vol. 3, p. 209 (
[58] Williams, U. S. 2,152,396 (1939).
[59] Bradley, U. S. 2,289,536 (1942).

CHAPTER XV

EMULSIFYING AGENTS

Formula No. 1[1]

TEN kg. of casein and 10 kg. of citric acid are mixed [illegible] heated with 100 l. of water. The solution is then diluted with a further 200 l. of water, the undissolved parts being [illegible]d. Potash lye is added hot until the pH is 7.4, and [illegible] solution is carefully concentrated. A homogeneous residue [illegible] obtained, which is completely soluble in water and is [illegible] suitable either as an emulsifying agent or detergent. It [illegible] be used by itself or with fat solvents or neutral soap.

Formula No. 2[2]

Pectin, Dry	4–5
Agar-Agar	1
Gelatin	½
Water	100

The pectin is dissolved in boiling water. The solution is cooled. The smooth jelly that forms is liquefied by stirring and run through a homogenizer.

The viscous liquid thus [illegible] can be used to emulsify oils in varying amounts.

Formula No. 3[3]

Cotto[illegible]	75
[illegible] Glycol	22
[illegible] Carbonate	1

He[illegible] stirring, for 1 hour at 125–130°C.

This mixture is soluble in mineral oil and disperses in warm water.

Formula No. 4 [4]

Castor Oil	46.6
Soy Bean Oil	112.5
Diethylene Glycol	44.0
Potassium Carbonate	2.0

Method as above.

Formula No. 5 [5]

Coconut Oil	137
Diethylene Glycol	44
Potassium Carbonate	2

Method as above.

Formula No. 6 [6]

Palm Kernel Oil	150
Diethylene Glycol	44
Potassium Carbonate	5

Method as above.

Formula No. 7 [7]

Castor Oil, Blown	85.0
Castor Oil Fatty Acids	15.0
Sodium Hydroxide (10%)	6.7

Formula No. 8 [8]

Diglycol Laurate	80
Carbitol	20

A good white water-in-oil cream emulsion is obtained from

Above Emulsifier	15
Mineral Oil	40
Water	45

Formula No. 9 [9]

Pectin	4–5
Agar	1

Gelatin	½
Water (Boiling)	100 cc.

Formula No. 10[10]

Soya Bean Flour	1.0
Water	150.0
Caustic Potash	0.1

Heat together and stir until uniform.

Formula No. 11[12]

Pectin	2–5
Agar	0.5–1.5
Gelatin	0–1
Gum Arabic	0–5

Formula No. 12[13]

Gum Tragacanth	20
Gum Arabic	5
Sodium Bicarbonate	13

Formula No. 13[14]

Gum Tragacanth	20
Locust Bean Gum	15
Sodium Bicarbonate	13

Formula No. 14[15]

Powdered Acacia	5
Powdered Tragacanth	5
Sugar	5
Starch	5
Boric Acid	1

Mix intimately. Use 1 part of above powder to every 32 parts of emulsion to be made. Eight oz. of the oil to be emulsified are put into a dry 32-ounce bottle, and shaken with ½ oz. of this powder. When the powder is evenly suspended, 8 ounces of water are added at once, and the mixture is shaken until a perfect emulsion is formed.

Formula No. 15[16]

Aerosol OT (100%)	40
Oleic Acid	42
Triethanolamine	18

The Aerosol OT (100%) is dissolved in the oleic acid by heating to 50°–60°C. The mixture is cooled to room temperature and the triethanolamine added. Five per cent of this emulsifier can be mixed with 95% of oil and 30–50% water added to give a thick creamy paste which can be further diluted with additional water.

Formula No. 16

Fifty-five parts of lauryl amide are mixed with 50 parts of formaldehyde (30%), 0.5 part of potassium hydroxide solution (50% concentration) and 300 parts of water. The mixture is agitated for half an hour at a temperature of 60°C. Fifty parts of phenol and 10 parts of a concentrated solution of hydrochloric acid are added and the mixture agitated for another hour. The viscous oil obtained from this treatment is an excellent emulsifier. It is mixed with 200 parts of sulfuric acid (monohydrate) at a temperature of 60–70°C. After the sulfonated mixture has been agitated for several hours, it is mixed with 200 parts of ice and slowly heated with agitation to a temperature of approximately 70°C. After agitation is stopped, the sulfonate formed quickly separates as a viscous oil over an aqueous solution of sulfuric acid. The latter is removed and the oily sulfonic acid is dissolved in water, neutralized, and evaporated. A product is finally obtained which possesses high detergent powers both in hard and soft water and is resistant to the action of hot acids and alkalies.

REFERENCES

[1] Bennett, Chem. Formulary, Vol. 2, p. 181 (1935).
[2] Bennett, Chem. Formulary, Vol. 4, p. 95 (1939).
[3] Bennett, Chem. Formulary, Vol. 4, p. 99 (1939).
[4] Bennett, Chem. Formulary, Vol. 4, p. 99 (1939).
[5] Bennett, Chem. Formulary, Vol. 4, p. 99 (1939).

[6] Bennett, Chem. Formulary, Vol. 4, p. 99 (1939).
[7] Bennett, Chem. Formulary, Vol. 4, p. 99 (1939).
[8] Bennett, Chem. Formulary, Vol. 4, p. 99 (1939).
[9] Bennett, Chem. Formulary, Vol. 4, p. 99 (1939).
[10] Bennett, Chem. Formulary, Vol. 4, p. 99 (1939).
[12] Preiser, Brit. 486,463 (1938).
[13] Personal Communication.
[14] Personal Communication.
[15] Bennett, Chem. Formulary, Vol. 2, p. 181 (1935).
[16] Amer. Cyanamid & Chem. Corp., New York.

CHAPTER XVI

BITUMINOUS EMULSIONS

Asphalt Emulsions

Formula No. 1[1]

Asphalt	64.05
Water	35.00
Caustic Soda	0.08
Corn Gluten (or Soya Bean Meal)	0.64
Green Acid Soap (Dry Basis)	0.23

THE asphalt for use in this formula may be produced from Mid-Continent petroleum, melting point about 110°F., penetration about 130 at 77°F.

Green acid soap may be prepared by the neutralization of green acids, which are well known in the petroleum industry. If the green acid soap contains appreciable amounts of oil, a harder asphalt should be emulsified, to produce a residue of given penetration.

The caustic, farinaceous emulsifier, and green acid soap are mixed with water and heated to a temperature of about 200°F. This hot solution or mixture is placed in a suitable stirrer, agitator or mixer and is beaten by paddles, circulated by centrifugal pumps or dispersed between suitable rotors moving at high velocities.

The melted asphalt at about the same temperature is slowly stirred into the solution and further agitated until complete emulsification has taken place. When high melting point asphalts are used it may be necessary to increase the temperature at which the asphalt is added, but it is desirable to keep the temperature of the emulsion below the boiling point of water so that the foaming due to the production of steam may be prevented.

Formula No. 2[2]

A sodium oleate solution is made up to a concentration of 20% by the addition of oleic acid and caustic soda to water at 90°C. This is then diluted with 9 times its volume of water heated to 90°C. The 2% soap solution is run through a colloid mill with an equal amount of asphalt heated to not exceeding 100°C. The resultant emulsion contains equal parts of asphalt and water with 1% by weight of soap.

Formula No. 3[3]

A hot dilute aqueous solution of alkali, such as a solution of caustic soda of about 0.5% strength, is prepared. An approximately equal weight of asphalt is melted; part of the melted asphalt is stirred into the hot solution slowly until scum begins to form on the surface; then a small quantity (about 0.5% of the final product) of oleic acid is added, followed by addition of the rest of the asphalt while the temperature and agitation are maintained and a small proportion of clay is added to give desired stability and adhesiveness.

Formula No. 4[4]

Rosin	100
Slaked Lime	3¾

Heat at 140°C. and mix until uniform.
Add while mixing

Fuel Oil	103

Take 4 lb. of the above mixture and add to 100 lb. melted bitumen or asphalt. Disperse the mixture in 0.05 N potassium rosinate solution to give a 57% bitumen content.

Formula No. 5[5]

Asphalt	48–52
Water	46–48

Oleic Acid	1
Sodium Hydroxide	Less than 1
Bentonite	1

Formula No. 6[6]

Nine parts of soap are dissolved in 78 parts of warm water. About 20 parts of a low-grade fuel oil or a crude oil with an asphaltic base are added slowly, with vigorous agitation.

Formula No. 7[7]

Asphalt	500
Water	500
Bentonite	30
Quebracho	30
Soda Ash	10

The bentonite, quebracho, soda ash, and water are mixed and heated to 200°F. While stirring, the asphalt, which has been heated to approximately 200°F., is added. The stirring is continued until the asphalt is dispersed.

Formula No. 8[8]

Asphalt	2800
Water	2800
Rosin Soap (50%)	118
Pine Oil	40

The rosin soap is added to the water and it is heated to 200°F. The asphalt is also heated to 200°F. and the pine oil added. While agitating, the asphalt is slowly poured into the water. The mixture is agitated until a smooth emulsion is formed.

Formula No. 9[9]

Hydrous Magnesium Silicate	8–10 lb.
Water	20 gal.

Mix well and heat to boiling; then mix in an emulsifying machine with

Asphalt, Melted	36 gal.
Acetic Acid (0.1 N.)	250–240 cc.
Water, Boiling	10 gal.

Formula No. 10[10]
(Adhesive for Sound-deadening Pads)

Asphalt	50–60
Bentonite	2–3
Oxalic Acid	0.02
Kerosene	3–10
Water	To make 100

The asphalt is warmed in the kerosene until dissolved. The bentonite and oxalic acid are dissolved in water and heated to boiling. The solutions are vigorously mixed and run through a colloid mill, if necessary.

Formula No. 11[11]
(Millboard Adhesive)

Asphalt	100
Tall Oil Soap (50% Water)	30
Kaolin	30

The tall oil soap and kaolin are mixed with heating and the molten asphalt slowly added, with stirring.

Before use, hot water in the desired quantity is added.

Bitumen Emulsions

Formula No. 1[12]

One thousand g. bitumen (preferably asphalt) are heated to 90°C. Sixty g. Swedish resin at 80–90°C. are then added and finally a solution of 20 g. caustic potash in 120 g. water, cooled to 60–70°C., is added. Vigorous stirring is needed throughout. One thousand g. hot water are poured in and when soap formation is ended 800 g. water are added in addition.

Formula No. 2[13]

Add 15 parts by weight of oleic acid to 250 parts by weight of asphalt flux oil, heating the mix to about 100°C. Add this to

750 parts of water to which have been added 34 parts of aqueous ammonia to form an emulsion of the asphalt flux oil, which has a viscosity substantially greater than that of water. Add 1500 parts by weight of coal tar, specific gravity of about 1.18 or more, heated to a temperature of about 70°C., to which has been added 45 parts of oleic acid. Vigorously agitate the tar with the emulsion of asphalt flux oil, and subject the resulting mixed emulsion to intensive mechanical disintegration, as, for example, by passage through a colloid mill.

Formula No. 3 [14]

An emulsion for road making contains 48% Spramex bitumen, 49.5% water, 2% oleic acid and 0.5% calcined sodium carbonate. The bitumen is warmed at 95–98°C., and the oleic acid added. The water is heated separately with the sodium carbonate and the two liquids are introduced into the emulsifier.

Formula No. 4 [14]

Spramex Bitumen	50
Mineral Oil	2–2.5
Resin Soap	1.5–2
Caustic Potash	1
Water	45

The bitumen is melted and the mineral oil added during agitation. The water is heated to boiling, and in it are dissolved the soap and the caustic potash. The liquids are mixed at 95°C. With more bitumen there must be added 1–2% of glue, starch, gelatin or sodium silicate, during or after emulsification.

Formula No. 5 [15]

Melt 100 parts of bitumen, softening point 45–50°C., and add 10.8 parts of rosin; heat to 100–125°C. Then add 20 parts of kaolin (soaked in equal parts by weight with water) and 1.2 parts of sodium hydroxide, preheated to 70–80°C. Raise the temperature of this mixture to 100°C., and dilute with water to produce an emulsion containing 20–25% of solids.

Formula No. 6[16]

Bitumen	35
Coal, Powdered	15
Carragheen	1
Water	50

Pitch Emulsion[17]

Coal Tar Pitch	180
Stearin Pitch	20

Melt together and add to following at 100°C.

*Casein Solution	45
Water	35
Caustic Potash	1

Then add

Water, Boiling	120

Tar Asphalt Emulsion[18]

Shale Tar	38.15
Water	49.60
Mexican Asphalt	7.63
Casein	1.15
Rosin	1.15
Potato Starch	0.76
Anthracene Oil	1.34

REFERENCES

[1] Bennett, Chem. Formulary, Vol. 2, p. 187 (1935).
[2] Bennett, Chem. Formulary, Vol. 1, p. 163 (1933).
[3] Personal Communication.
[4] Bennett, Chem. Formulary, Vol. 4, p. 97 (1939).
[5] Bennett, Chem. Formulary, Vol. 2, p. 186 (1934).
[6] Bennett, Chem. Formulary, Vol. 2, p. 186 (1934).
[7] Bennett, Chem. Formulary, Vol. 1, p. 155 (1933).

---

* Casein Solution:

Casein	56	Water	494
Caustic Potash (50%)	10	Cresylic Acid	11

[8] Bennett, Chem. Formulary, Vol. 1, p. 155 (1933).
[9] Bennett, Chem. Formulary, Vol. 4, p. 96 (1939).
[10] U. S. Patent 2,333,779.
[11] Bennett, Chem. Formulary, Vol. 7, p. 39 (1945).
[12] Bennett, Chem. Formulary, Vol. 4, p. 97 (1939).
[13] Bennett, Chem. Formulary, Vol. 4, p. 97 (1939).
[14] Bennett, Chem. Formulary, Vol. 1, p. 329 (1933).
[15] Bennett, Chem. Formulary, Vol. 5, p. 72 (1941).
[16] Bennett, Chem. Formulary, Vol. 5, p. 72 (1941).
[17] Bennett, Chem. Formulary, Vol. 4, p. 97 (1939).
[18] Bennett, Chem. Formulary, Vol. 5, p. 73 (1941).

CHAPTER XVII

CLEANERS AND SOAPS

Dry Cleaners' Soaps

Formula No. 1[1]

Xylol	10
Carbon Tetrachloride	10
Diglycol Laurate	7
Water	23

Add the xylol, carbon tetrachloride and diglycol laurate slowly to the water while mixing with a high-speed stirrer.

Formula No. 2[2]

a. Oleic Acid	46.0
b. Caustic Soda (25%)	27.0
c. Alcohol	45.4
d. Trichlorethylene	900.0

Saponify *a* with *b* on a waterbath. Add *c* and reflux to clear solution. Add this clear alcoholic soap solution to *d* with stirring, and let cool.

Water emulsifies this fluid readily.

Formula No. 3[3]

Oleic Acid	370
Stearic Acid	80
Potassium Carbonate	80
Water	70
Benzine	395
Stronger Ammonia Water	5

Melt the stearic acid and dissolve it in the warmed oleic acid. To this add the warm benzine and mix thoroughly. Dissolve the carbonate in the water and add this, with constant stirring, into the benzine mixture. Finally add the ammonia and beat into a homogeneous paste.

Formula No. 4[4]

Liquid Soap (15%)	40
Hydrocarbon Solvent	10
Turkey Red Oil or Other Emulsifier	25
Alcohol (Methyl Glycol, Ethanol, etc.)	25

Formula No. 5[5]

a. Trihydroxyethylamine Stearate	5
b. Kerosene	16
c. Cresylic Acid	1
d. Water, Boiling	45

Heat *a* and *b* until dissolved; add *d* slowly, while stirring with high speed mixer; add *c*.

Pine Oil Soap

Formula No. 1[6]

Glycol Laurate	5
Pine Oil	25

Mix and add to following while stirring vigorously

Water	50
Caustic Soda	¼

Formula No. 2[7]

Water	8.0
Solid Caustic Soda	2.5
Alcohol	10.0
Pine Oil	18.0
Red Oil (Oleic Acid)	17.5
Water	44.0

Mix the ingredients, while stirring, in the order given, at a temperature of about 40°C.; finally adjust with red oil or alkali until a sample dissolved in alcohol is neutral to phenolphthalein.

Formula No. 3 [8]

Potash Corn Oil Soap	96–97
Pine Oil	4–3

Emulsion Solvent Soaps

Formula No. 1

Pine Oil	300
Soya Bean Oil Fatty Acid	100
Water	60

Warm gently to be liquefied, then add

Caustic Potash (50° Bé.)	40

One part of the above mixes with 4 parts of turpentine, or benzine, or carbon tetrachloride, or dichloroethylene, or naphtha. These give excellent emulsions in water (1:1 to 1:2).

Formula No. 2 [9]

Pine Oil Soap (Above Formula)	12.5
Pine Oil	12.5
Spindle Oil (Refined 2° Engler, at 50° C.)	75

This makes a clear oil that gives excellent emulsions with water.

Formula No. 3 [10]

Linseed Oil	500
Hexalin	250–300
Potash Lye (50° Bé.)	199
Water	1208

Formula No. 4 [11]

Linseed Oil Fatty Acids	500
Methyl Hexalin	750

Potash Lye (50° Bé.)	208
Water	292

Formula No. 5[12]

Linseed Oil	184
Hexalin	275
Potash Lye (50° Bé.)	73.5
Water	387
Carbon Tetrachloride	80

Formula No. 6[13]

Coconut Oil	51
Linseed Oil	42
Hexalin	130
Potash Lye (50° Bé.)	42
Water	615
Carbon Tetrachloride	120

Equal weights of benzine or high-boiling petroleum distillates may be used in place of carbon tetrachloride.

Formula No. 7[14]

Soap	35
Cyclohexanol	10
Water	55

Formula No. 8[15]

Soap	28
Trichloroethylene	10
Water	60
Potassium Carbonate	2

Formula No. 9[16]

Soap	30
Trichloroethylene	25
Water	45

Formula No. 10[17]

Soap	5
Ammonia (Sp. Gr. 0.880)	25

Cyclohexanol	10
Water	60

Formula No. 11 [18]

Soap	10
Ammonia (Sp. Gr. 0.880)	5
Tetralin	10
Water	75

Auto Radiator Cleaner [19]

Kerosene	25
Orthodichlorobenzene	25
Borax	5
Diglycol Oleate	5
Water	40

The borax is dissolved in the water and the other ingredients dissolved in the kerosene; the two solutions are then emulsified together, making a stable emulsion.

When the cleaning composition is to be used, it is added to the water in the cooling system of an engine, and the engine is started so that the water, by its circulation, carries the emulsion to all parts of the system. While the water is still cool, the oily ingredients, together with the diglycol oleate dissolved in them, penetrate the solid deposits in the system and dissolve or soften any grease contained in the deposits. When the water is sufficiently heated by the continued operation of the engine, the borax reacts with the diglycol oleate to produce a water-soluble soap, thus disintegrating the deposits and producing an oil-in-water emulsion. The cooling water and the emulsified materials are then drained from the system. Any remaining solids which have been loosened and disintegrated, may be flushed from the system with additional water.

Chromium Plate Cleaners

Formula No. 1[20]

Amorphous Silica	5.0
Bentonite	1.0
Orthodichlorobenzene	10.0
Triethanolamine Oleate	3.0
Oleic Acid	0.5
Water	80.0

Formula No. 2[21]

Bentonite	5
Stearic Acid	5
Orthodichlorobenzene	40
Water	50

Formula No. 3[22]

Mineral Oil	13.0
Pine Oil	3.0
Ammonium Oleate	2.0
Ammonium Oxalate	3.0
Tripoli	25.0
Ammonia	0.5
Water	54.0

Graphite Cleaner[23]

Hexalin	2 qt.
Pine Oil	4 qt.
Soap Solution (1%)	3 gal.

The ingredients are mixed together to form a fairly stable emulsion. Hot water is added, with constant stirring until the emulsion is diluted to 50 gal.

Ink Remover

Formula No. 1[24]

a. Naphtha	10
Trichlorethylene	20

	Methyl Hexalin	5
	Soft Soap	25
b.	Ammonium Sulfate	25
	Water	100
c.	Pumice Powder 000 Chalk Powder	Equal Parts

Mix solution *a* with a paste prepared from *b* and *c*.

Formula No. 2[25]

a.	Pumice Powder	50
	Soap Powder	30
	Trisodium Phosphate	15
	Ammonium Sulfate	5
b.	Turpentine Methyl Hexalin Carbon Tetrachloride	Equal Parts

Lacquer Remover for Hands[26]

Butyl Acetate	13
Soap	15
Carbon Tetrachloride	7
Glycerin	7
Diatomaceous Earth	14
Sand	19
Water	25

Greasy Leather Cleaner[27]

Water	10.00 gal.
Castile Soap	0.75 lb.
Trichlorethylene Soap	3.50 lb.
Methyl Acetone	0.50 gal.
Lemon Grass Oil	0.15 lb.

Dissolve soap in water by heating and stirring. Cool and stir in other ingredients.

Metal Cleaner[28]

Fatty Acid	8
Alcohol	15

Ammonia (Sp. Gr. 0.91)	4
White Spirit	58
Fatty Alcohol Sulfate (Wetanol)	2
Neuburg Chalk	50

Soap Paste Paint Cleaner

Formula No. 1 [29]

Soap Chips	20.00
Mineral Spirits	10.00
Water	69.30
Sassafras Oil	0.07

Formula No. 2 [30]

a.	Naphtha	½	gal.
	Diglycol Stearate	1	lb.
b.	Trisodium Phosphate	4	oz.
	Water	3	qt.

Heat *a* on a water bath and stir until dissolved. Heat *b* to boiling and add it to *a* slowly while mixing vigorously.

Painted Woodwork Cleaner

Formula No. 1 [31]

Diglycol Stearate	1	lb.
Kerosene	¼	gal.
Trisodium Phosphate	4½	oz.
Water	12	pt.

The diglycol stearate and kerosene are heated together in a double boiler until the stearate is dissolved. The trisodium phosphate is dissolved in the water and heated in another container to a temperature of about 150°F. The hot water solution is then added to the hot kerosene solution, with stirring at high speed. Stirring should be continued at a good rate until the mixture is of even milky consistency. Mixing may be continued at a slow rate until the batch has cooled to around 85°F.

Formula No. 2[32]

Diglycol Stearate	1 lb.
Kerosene	½ gal.
Trisodium Phosphate	4½ gal.
Water	¾ gal.

The method of preparation is the same as for formula No. 1.

Formula No. 3[33]

Duponol LS Paste or Duponol ES Paste	47.6
Hexalin	4.8
Tetralin	47.6

Prepare by adding the Duponol LS Paste to the previously mixed solvents.

Formula No. 4[34]

Duponol LS Paste	15
Hexalin	2
Pine Oil	3
Tetralin	70
Water	10

Mix together at room temperature the Duponol, hexalin and pine oil. Stir until a clear mixture is formed. Continue stirring and add the tetralin slowly. After the tetralin has been added and the mixture thoroughly agitated, add the water and stir until a homogeneous milky emulsion is formed.

Rug Cleaner

Formula No. 1[35]

Diglycol Oleate	44
Butyl Cellosolve	5
Ethylene Dichloride	12
Alcohol	15
Oleic Acid	11
Ammonium Hydroxide	11
Water	45

This mixture may be thinned by increasing the amount of water.

Formula No. 2[36]

a.	Oleic Acid	35
	Trigamine	15
	Water	125
b.	Butyl Cellosolve	5
	Ethylene Dichloride	13
c.	Diethylene Glycol	15
	Isopropyl Alcohol	20

Mix *a* and add *b* with high-speed agitation. Add *c* slowly. Continue stirring.

Upholstery Cleanser[37]

Coal-Tar Naphtha	27
Tallow Soap	1
Triethanolamine Oleate	1
Water	71

Saddle Soap

Formula No. 1[38]

Beeswax	500
Caustic Potash	80
Water	800

Boil for 5 minutes, while stirring. In another vessel heat

Castile Soap	160
Water	800

Mix the two with good stirring; remove from heat and add

Turpentine	1200

while stirring well.

Formula No. 2[39]

Carnauba Wax	54
Soap Flakes	20
Tallow	26
Turpentine	21
Sperm Oil	6
Water	5

Washing Compound[40]

Paraffin Wax	8 lb.
Soap, White	4 lb.
Borax	16 oz.
Potassium Carbonate	4 oz.
Water	1 gal.

Dissolve the borax and carbonate with heat in one-third of the water. Shave the soap and dissolve it in the rest of the water, adding the borax and carbonate solution after the soap has softened. Melt the wax by heating and, while hot, pour into it gradually the hot soap solution. Remove from the fire, continue stirring until cold.

Composition to Clean Wooden Surfaces[41]

Montan Wax, Double Bleached	4
Paraffin Wax (50/52°C.)	6
Soap, Castile	1
Water	68
Methyl Alcohol	20
Ammonia, Concentrated	1

Color with any water-soluble color.

Cleaner Emulsion for Printing Rolls[42]

a.	Oleic Acid	45.5
	Caustic Soda	8.5
	Water	26.5
b.	Alcohol	45.5
c.	Trichlorethylene	900.0

Saponify *a* to give a clear soap gel. Dissolve by working in *b;* stir steadily and add *c* slowly, until completely mixed. Dilute with water for use.

Cleanser for Rubber Rugs[43]

Oleic Acid	8
Triethanolamine	3
Water	30
Spindle Oil	40

REFERENCES

[1] Bennett, Chem. Formulary, Vol. 4, p. 497 (1939).
[2] Bennett, Chem. Formulary, Vol. 4, p. 497 (1939).
[3] Bennett, Chem. Formulary, Vol. 1, p. 76 (1933).
[4] Bennett, Chem. Formulary, Vol. 4, p. 496 (1939).
[5] Bennett, Chem. Formulary, Vol. 1, p. 76 (1933).
[6] Bennett, Chem. Formulary, Vol. 3, p. 325 (1936).
[7] Bennett, Chem. Formulary, Vol. 1, p. 84 (1933).
[8] Personal Communication.
[9] Bennett, Chem. Formulary, Vol. 3, p. 324 (1936).
[10] Bennett, Chem. Formulary, Vol. 3, p. 322 (1936).
[11] Bennett, Chem. Formulary, Vol. 3, p. 322 (1936).
[12] Bennett, Chem. Formulary, Vol. 3, p. 322 (1936).
[13] Bennett, Chem. Formulary, Vol. 3, p. 322 (1936).
[14] Bennett, Chem. Formulary, Vol. 3, p. 322 (1936).
[15] Bennett, Chem. Formulary, Vol. 3, p. 322 (1936).
[16] Bennett, Chem. Formulary, Vol. 3, p. 322 (1936).
[17] Bennett, Chem. Formulary, Vol. 3, p. 322 (1936).
[18] Bennett, Chem. Formulary, Vol. 3, p. 322 (1936).
[19] Bennett, Chem. Formulary, Vol. 5, p. 574 (1941).
[20] Bennett, Chem. Formulary, Vol. 5, p. 574 (1941).
[21] Bennett, Chem. Formulary, Vol. 5, p. 574 (1941).
[22] Bennett, Chem. Formulary, Vol. 5, p. 574 (1941).
[23] Bennett, Chem. Formulary, Vol. 4, p. 501 (1939).
[24] Bennett, Chem. Formulary, Vol. 5, p. 574 (1941).
[25] Bennett, Chem. Formulary, Vol. 5, p. 574 (1941).
[26] Bennett, Chem. Formulary, Vol. 4, p. 511 (1939).
[27] Bennett, Chem. Formulary, Vol. 4, p. 511 (1939).
[28] Bennett, Chem. Formulary, Vol. 5, p. 574 (1941).
[29] Bennett, Chem. Formulary, Vol. 3, p. 325 (1936).
[30] Bennett, Chem. Formulary, Vol. 4, p. 511 (1939).
[31] Personal Communication.
[32] Personal Communication.
[33] E. I. du Pont de Nemours & Co., Wilmington, Del.
[34] E. I. du Pont de Nemours & Co., Wilmington, Del.

[35] Bennett, Chem. Formulary, Vol. 1, p. 77 (1933).
[36] Bennett, Chem. Formulary, Vol. 4, p. 496 (1939).
[37] Bennett, Chem. Formulary, Vol. 4, p. 497 (1939).
[38] Bennett, Chem. Formulary, Vol. 1, p. 84 (1933).
[39] Bennett, Chem. Formulary, Vol. 1, p. 84 (1933).
[40] Crowley, Money Making Formulas, p. 90 (1939).
[41] Personal Communication.
[42] Bennett, Chem. Formulary, Vol. 4, p. 497 (1939).
[43] Bennett, Chem. Formulary, Vol. 4, p. 514 (1939).

CHAPTER XVIII

COSMETIC AND DRUG EMULSIONS

All-purpose Creams

Formula No. 1[1]

a. Parachol (Absorption Base)	25
b. Lanolin, Anhydrous	10
c. Mineral Oil	20
d. Paraffin Wax	2
e. Ozokerite, White	6
f. Glycol Bori-Borate	2
g. Water	50

Melt together *a, b, c, d,* and *e* on a water-bath and keep at 50°C. Add solution of *f* in *g* heated to 50°C. a little at a time, using a low-speed mixer with large paddles. Do not add additional amounts of water until first addition has been absorbed. Stir until temperature falls to 42°C. and then mix in a little perfume. Then pass through an ointment or colloid mill.

Formula No. 2[2]

Sorbitol Distearate	10
Mineral Oil	20
Lanolin	3
Glycerin	5
Beeswax	4
Ceresin Wax	10
Water	48

Formula No. 3[3]

Beeswax	6.00
Spermaceti	2.00
Petrolatum	5.00

Raisin Seed Oil	50.60
Mineral Oil	10.00
Rancidex (Preservative)	0.10
Water	25.00
Borax	0.60
Triethanolamine	0.20
Perfume	0.50

Melt fats and oils at 160°F. Heat the water and borax in a separate kettle at the same temperature. Emulsify by adding water to oils at 160°F. with constant stirring. Add perfume oils at 115°F.

Formula No. 4[4]

* Cosmetic Base	22
Mineral Oil	25
Lanolin	3
Beeswax (Bleached)	7
Water	43

Skin Lotions

Formula No. 1[5]

Mineral Oil	50
Camphor	2
Diglycol Laurate	20

Mix together until dissolved and add with stirring.

Water	120

Formula No. 2[6]

Glyceryl Monostearate	6.0
Water	75.5
Glycerin	10.0
Stearic Acid	1.0
Oleic Acid	2.0

---

* The cosmetic base may be made up of 10% sorbitol monooleate and 90% petrolatum or 10% sorbitol distearate and 90% petrolatum.

Formula No. 3 [8]

Stearic Acid, Triple Pressed	12
White Mineral Oil	30
Triethanolamine	4
Glycerin	4
Perfume	½
Water	80

Formula No. 4 [9]

* Base Emulsion	550
Distilled Water	445
Perfume	5

Moisten the pectin with a little alcohol and then mix it with a small amount of water, in which the citric acid is dissolved, until a fine mucilage is obtained. The pectin swells to a large extent. In the rest of the water dissolve the liquid chamomile extract and add the warm solution a little at a time to the pectin mucilage. When all the water has been added, heat until a uniform solution results, avoiding overheating. The oil is then emulsified with this solution, preferably in a colloid mill or a homogenizer.

Formula No. 5 [10]

Mineral Oil	70
Olive Oil	8
Trihydroxyethylamine Stearate (Special)	14
Water	70
Perfume	2

Formula No. 6 [11]

Stearic Acid	3.00
Alcohol	5.00
Mineral Oil	5.00
Triethanolamine	2.00

---

* Base Emulsion

Distilled Water	710	Citric Acid	10
Mineral Oil	180	Extract Chamomile Flowers	50
Dried Pectin	50		

Glycerin	5.00
Water	75.85
Quince Seed	3.50
Perfume	0.50
Preservative	0.15

Formula No. 7 [12]

Water, Distilled	74
Sesame Oil	20
Citrus Pectin	5
Citric Acid	1

Vigorous stirring of an acidified 5% pectin solution with 20% sesame oil yields a stable viscous emulsion which disperses readily when poured into water. If such emulsions are homogenized and kept in closed containers, they will remain stable for years.

Formula No. 8 [13]

Mineral Oil	72
Trihydroxyethylamine Stearate (Special)	14½
Water (Warm)	160
Perfume	1½

Heat the mineral oil and trihydroxyethylamine stearate until just melted together, and stir. Next add the warm water slowly with thorough stirring and continue until the batch is homogeneous. Allow to stand one night and stir for 15 minutes before packing.

This cream washes off easily with cold water. The consistency can be changed by varying the amount of water in this formula.

Formula No. 9 [14]

Lanolin	20
Almond Oil	80
Stearic Acid	40
Diglycol Stearate	10
Vitamin F (50,000 units per g.)	5

Vegetable Lecithin	1
Triethanolamine	20
Glycerin	30
Water	800
Perfume	To suit

Formula No. 10[15]

Beeswax, White	1.00
Quince Seed	2.75
Stearic Acid	1.65
Borax	2.50
Glycerin	3.00
Water	85.45

Formula No. 11[16]

Glyceryl Monostearate	10
Cocoa Butter	2
Glycerin	5
Anhydrous Lanolin	2
Stearic Acid	1
Water	80

Add the ingredients to the water, turn on the heat and bring to the boiling point with constant stirring. When all the ingredients are melted and a clear emulsion is formed, shut off the heat.

Formula No. 12[17]

Lanolin	12
Mineral Oil	20
Trihydroxyethylamine Stearate (Special)	4¼
Glycosterin	2
Glycerin	8
Water	200
Benzoate of Soda	¼
Perfume	To suit

Formula No. 13[18]

Spermaceti	2.00
White Beeswax	0.25
Glycerin	6.00

Soap	3.00
Borax	0.50
Sodium Benzoate	0.20
Quince Seed	3.40
Alcohol	4.00
Water	80.00
Perfume	0.50
Preservative	0.15

Formula No. 14[19]

Spermaceti	3.75
White Beeswax	0.75
Glycerin	2.00
Pulverized Neutral White Soap	1.50
Borax	0.35
Almond Oil	3.00
Quince Seed	2.50

Formula No. 15[20]

a. Mineral Oil	35
b. White Wax	2
c. Trihydroxyethylamine Stearate (Special)	8
d. Perfume (Almond)	1
e. Water	50

Heat *a*, *b* and *c* together to 140°F. and stir until homogeneous. Heat *c* to 140°F. and run slowly into the above mixture, stirring thoroughly. When the temperature has dropped to 105°F. add the perfume drop by drop, stirring until completely absorbed. Continue stirring until cool and package.

Formula No. 16[21]

Peanut Oil	100
Lanolin	20
Moldex (Preservative)	1
Triethanolamine Oleate	2–4
Water	200

Formula No. 17[22]

Raisin Seed Oil	17.50
Stearic Acid (Triple Pressed)	5.50

Rancidex	0.10
Water	70.00
Triethanolamine	1.00
Alcohol	5.50
Perfume	0.40

Melt oil, stearic acid and preservative at 155°F. Bring water and triethanolamine to same temperature. Add oils to water at 155°F., with slow stirring. Stir until cold. Add alcohol and perfume last.

Formula No. 18 [23]

Lanolin	2
Glycosterin	19
Dextrin	4
Glycol Bori-Borate	3
Water	72

Formula No. 19 [24]

a.	Myristyl Alcohol	30
	Petroleum Jelly	9
b.	Glycerin	7
	Water	30

Melt *a* on the water-bath. Heat *b* to 60°C., and add it to *a* with agitation. Stir until cool.

Formula No. 20 [24a]

Cetyl Alcohol	68
Medicinal Soap	18
Glycerin	23
Mineral Oil	91
Water	780
Perfume	20

Beauty Milk [25]

Mineral Oil	12
Grapeseed Oil	6
Cetyl Alcohol	1
Triethanolamine	2

Stearic Acid	5
Glycerin	4
Distilled Water	70
Perfume	To suit

Acid Skin Milk[26]

Olive Oil (Deodorized)	10
Paraffin Wax	6
Liquid Paraffin	5
Petroleum Jelly	10
Acimul	12
Water	110
Lemon Juice	3
Preservative	To suit

Bath Milk[27]

Triethanolamine	1
Stearic Acid	5
Glycerin or Diethylene Glycol	6
Tincture Benzoin (6%)	8
Acacia or Quince Seed Mucilage	8
Perfume Compound	To suit
Distilled Water	72

Bath Oil[28]

Sulfonated Oil	75
Perfume Oil	15
Diethylene Glycol	10

Distilled water may be added if desired, although a highly concentrated bath oil is usually to be preferred.

Almond Oil Emulsion[29]

Almond Oil	81
Triethanolamine Oleate	6
Oleic Acid	6
Water	81

Lanolin Emulsion[30]

Diglycol Oleate (Light)	10
Lanolin (Anhydrous)	30

Warm the diglycol oleate and lanolin until dissolved. Add with rapid agitation

Water	60

made slightly alkaline with caustic soda (0.25%). Stir 5 to 10 minutes.

Cleansing Creams

Formula No. 1[31]

Lanolin	22
White Mineral Oil	25
White Petroleum Jelly	11
Distilled Water	42
Perfume	To suit

Formula No. 2[32]

a. Mineral Oil (White)	54.0
b. Beeswax	18.0
c. Parachol	5.5
d. Borax	1.0
e. Water	21.0
f. Perfume	0.5

Melt together *a*, *b* and *c*. Dissolve *d* in *e* and heat to boiling. Add this to first mixture, slowly, with stirring; add perfume before solidification begins.

Formula No. 3[33]

a. Mineral Oil	80
b. Spermaceti	30
c. Glycosterin	24
d. Water	90
e. Glycerin	10
f. Perfume	To suit

Heat *a, b* and *c* to 140°F. and stir into it, slowly, *d* and *e* heated to same temperature. Add perfume, at 105°F.; stir slowly until cold after allowing to stand for 5 minutes. Stir until smooth and pack.

Formula No. 4 [34]

a.	Mineral Oil	78
	White Wax	5
	Spermaceti	28
	Trihydroxyethylamine Stearate (Special)	20
b.	Perfume	1
c.	Glycerin	4
	Water	92

Heat *a* and *c* separately to 200°F.; then add *a* to *c* slowly, stirring thoroughly. When the cream begins to set, the perfume is added and stirred in. Allow to stand overnight. Stir thoroughly the next morning and package.

Formula No. 5 [35]

Stearic Acid	29
Lanolin (Anhydrous)	8
Mineral Oil (White)	50
Triethanolamine	3.6
Carbitol	10
Water	100

Melt the stearic acid in the mineral oil, add the lanolin and bring the temperature of this oil solution to 70°C. Then add it to the solution of triethanolamine and water which has been brought to the boiling point in a separate container. Stir vigorously to obtain a uniform emulsion and add the Carbitol solution of the perfume. Continue with even stirring until a smooth cream is obtained and then occasionally until cold. Too rapid stirring causes an undesirable aeration of the cream.

Formula No. 6 [36]

Ammonium Stearate (Paste)	250
Mineral Oil, White	25
Perfume	To suit

Stir until most of the ammonia has evaporated.

	Formula No. 7 [37]	Formula No. 8 [37]
Stearic Acid	8.0	8.0
Paraffin	7.0	...
Mineral Oil	30.0	35.0
Petrolatum	...	10.0
Ceresin	2.0	...
Amino Glycol	3.0	3.0
Glycerin	...	5.0
Water	50.0	39.0

Formula No. 9 [38]

Sorbitol Monooleate	5
Sorbitol Distearate	10
Beeswax	7
Mineral Oil	32
Lanolin	3
Water	43

This combination gives a moderately firm cream with a fine-grained texture.

Formula No. 10 [39]

U.S.P. Flaked White Beeswax	10
Ceresin Wax (Melting Point 138°F.)	5
Mineral Oil (Viscosity 68/75)	65
Water	40
Borax	½
Perfume	Sufficient

The beeswax, ceresin and a portion of the mineral oil are placed in a steam-jacketed kettle and the temperature in melting the waxes should be at no time in excess of 80°C. The emulsifying power of beeswax is retarded or broken down when the temperature is too high.

Adjust the steam so that the temperature remains at 57°C. on addition of the rest of the mineral oil cold. Add the perfume oil, with stirring.

In another kettle, bring the water and borax to 57°C. Add the water and borax solution to the melted waxes and oils, with agitation. Stir until the cream thins down and becomes a homogeneous mass; continue stirring for a few minutes only.

Formula No. 11[40]

Sorbitan Monostearate	12
Olive Oil, Deodorized	40
Water	48
Preservative	Sufficient

Formula No. 12[41]

Lanette Wax SX	12
Lanette Wax K	6
Sorbitan Monooleate	2
Raisin-Seed Oil	10
Sorbitol Syrup	5
Water	65
Preservative	Sufficient

Formula No. 13[42]

Glyceryl Monostearate	14
Liquid Paraffin	10
Stearyl Alcohol	1
Sorbitan Monooleate	1
Sorbitol Syrup	5
Water	69
Preservative	Sufficient

Formula No. 14[43]

Liquid Paraffin	10.0
Stearic Acid	3.3
Isopropanolamine	1.7
Sorbitan Monostearate	2.0
Sorbitan Monooleate	2.0
Water	79.0
Preservative	Sufficient

Formula No. 15[44]

Sorbitol Monooleate	1.0
Sorbitol Monostearate	1.0

Sorbitol Syrup	1.0
Stearyl Alcohol	1.0
Stearic Acid	1.0
Isopropanolamine	0.5
Water	94.5
Preservative	Sufficient

Formula No. 16[45]

Mannitan Monolaurate	10
Olive Oil, Deodorized	30
Water	60
Preservative	Sufficient

Cold Creams

Formula No. 1[46]

Diglycol Stearate	14	lb.
Paraffin Wax	2	lb.
Mineral Oil	3¾	gal.
Petrolatum (White)	6	lb.
Water	6	gal.
Perfume Oil	5½	fl. oz.

Melt the diglycol stearate, paraffin wax, mineral oil and petrolatum at 170°F. Heat the water to 180°F.

Add the water to the melted fats and oils, while mixing. Allow mixer to run until batch is completely emulsified.

Allow batch to cool to 125°F.; add the perfume oil and mix at low speed. The batch should be allowed to cool without stirring to 105°F. at which temperature it is poured into jars.

Formula No. 2[47]

Stearic Acid	15
Butyl Stearate	5
Amino Glycol	2
Zinc Stearate	15
Water	63

Formula No. 3[48]

Glyceryl Monostearate	8
Magnesium Stearate	14

Beeswax	3
Petrolatum	10
Mineral Oil, White	5
Water	60

Formula No. 4 [49]

A very low-priced light-bodied greaseless but stable cream is made as follows:

a.	Glycosterin	22
	Petrolatum, White	16
	Paraffin Wax	12
	Mineral Oil	32
b.	Water	128
	Borax	3
	Potassium Carbonate	2
c.	Perfume	To suit

Heat *a* and *b* separately to 80°C. and pour *b* into *a* slowly while stirring. Add perfume at 55°C. stir and pack. If cold packed, a high gloss is given to surface by passing a flame lightly over surface in each jar.

Formula No. 5 [50]

Cetyl Alcohol	100
White Beeswax	150
Vegetable Oil	200
Mineral Oil	250
Cholesterin	5
Borax	10
Water	260
Perfume	25

Formula No. 6 [51]

Stearic Acid Esters of Polyethylene Glycol	10
Stearic Acid	10
Paraffin Wax	15
Mineral Oil	15
Petrolatum	10
Salt, such as Sodium Chloride	6
Water	To make 100

Cosmetic Creams

Formula No. 1[52]

Stearyl Alcohol	1.0
Mannitan Monooleate	3.5
Raisin Seed Oil	5.0
Petroleum Jelly	45.0
Water	45.5

Formula No. 2[53]

a.	Beeswax	540
	Spermaceti	300
	Mineral Oil	1730
	Stearin	430
b.	Water	720
	Borax	100
	Sodium Benzoate	10
	Perfume	

The borax and benzoate of soda are dissolved in the water and brought to boiling. While still hot, the aqueous solution is added to the melted *a*. Allow to cool with slow agitation. Add perfume.

Formula No. 3[54]

a.	Ceresin, White	27
	Spermaceti	25
	Stearic Acid	21
	Undecylic Acid	1
	Mineral Oil, White	87
b.	Borax	5
	Water, Distilled	36

Melt *a* and add with agitation to the hot solution *b*. Stir until cold.

Formula No. 4[55]

Cetyl Alcohol	10
Paraffin, Liquid	10

Vaseline, White	80
Water	60

This makes a transparent, soft, white cream.

Formula No. 5 [56]

Mineral Oil	1 gal.
White Beeswax	2 lb.
Water (Preferably Distilled)	½ gal.
Powdered Borax (Bolted)	2 oz.

Mix beeswax and oil in one container. Bring to 150°F. then cool to 120°F. Dissolve the borax in water; bring to 120°F.; pour slowly into the wax and oil mixture, stirring constantly but not rapidly. At 115°F., perfume and pour into containers.

Formula No. 6 [57]

Stearic Acid	16
Glycerin	48
Mineral Oil	12
Paraffin Wax	2
Stronger Ammonia Water	4
Water	64
Perfume	¾

Formula No.	7 [58]	8 [58]	9 [58]	10 [58]
Sorbitol Syrup	3.0	8.0	5.0	2.5
Potassium Carbonate	0.7		0.7	
Potassium Hydroxide		1.0		
Triethanolamine				1.7
Water	76.4	64.1	45.1	70.9
Preservative (Moldex)	0.1	0.1	0.1	0.1
Stearic Acid	15.0	20.0	10.0	3.5
Lanolin	0.5	1.5	0.5	2.0
Mineral Oil	2.0	2.0	35.3	15.0
Mannitan Monooleate	2.0	1.0	1.0	2.0
Mannitan Monostearate			2.0	2.0
Spermaceti		2.0		
Perfume	0.4	0.4	0.4	0.4

Formula No. 11 [59]

Spermaceti	125
White Wax	120
Liquid Petrolatum	560
Borax	5
Distilled Water	190
Oil of Rose, Synthetic	Sufficient

Formula No. 12 [60]

Stearic Acid of Polyethylene Glycol	15
Spermaceti	5
Glycerin	3
Aluminum Chloride, Hydrated Crystals	12
Water	To make 100

Formula No. 13 [61]

Zinc Sulfate	0.15
Alum	0.2
Acacia (Powdered)	4.0
White Beeswax	15.5
Glycerin	13.0
Sodium Benzoate	0.1
Cocoa Butter	3.0
Perfume	0.5
Distilled Water	63.53

	Formula No. 14 [62]	15 [62]
Stearic Acid	8	8
Paraffin	7	
Mineral Oil	30	35
Petrolatum		10
Ceresin	2	
Amino Glycol	3	3
Glycerin		5
Water	50	39

Formula No. 16 [63]

Stearic Acid	4.0
Cetyl Alcohol	1.0

Butyl Stearate	3.0
Amino Glycol	0.8
Quince Seed	0.5
Water	90.7

Formula No. 17[64]

Stearic Acid	30
Lanolin (Anhydrous)	20
White Beeswax	16
White Mineral Oil	33
Triethanolamine	3.8
Carbitol	16
Water	95

Formula No. 18[65]

White Mineral Oil	73.5
White Beeswax U.S.P.	16.5
Paraffin Wax	5.0
Ozokerite	5.0

Heat to a temperature slightly above its melting point. The proper type of perfume is then added.

In a separate container, 1½ lb. borax is dissolved in water. The amount of water can vary from 26 to 36 lb. per 100 lb. of finished cold cream.

The borax dissolved in the water, which is heated almost to the boiling point (approximately 200°F.), is then added all at one time to the above mixture. During the addition of the borax water the mixture is stirred and the stirring is continued until a complete emulsion has been formed. The cream should be filled into the jars while still warm enough to pour easily so that it will have a perfectly smooth and even appearance at normal temperature.

Caution: If the water is not hot enough when added to the base, drops of water from the cream will separate upon standing. If the stirring is not properly done or not continued long enough, the cream will likewise separate.

Formula No. 19 [66]

White Mineral Oil	45.0
White Beeswax U.S.P.	13.0
Spermaceti	6.0

Heat all together until liquid; then add under stirring

Powdered Borax	1.0
Water	35.0

which has been heated to about 85°C.

Formula No. 20 [67]

Apricot Kernel Oil	54
White Beeswax	13
White Ceresin Wax	8½
Ethyl Amino Benzoate	½
Borax Powder	½
Distilled Water	25

Melt apricot kernel oil, beeswax and ceresin wax together and add the ethyl amino benzoate. Stir until dissolved. Adjust temperature to 65°C. Dissolve borax in hot distilled water and filter. Adjust temperature to 65°C. Then add borax solution slowly while stirring to the oil and wax mixture kept at the same temperature and stir until cold.

Formula No. 21 [68]

Beeswax	15.0
Petrolatum	14.0
Mineral Oil	50.0
Water	20.0
Borax	0.5
Perfume	0.5

Melt wax and petrolatum. Add oil. Dissolve borax in hot water. Add to above with stirring. Perfume at 120°F.

Formula No. 22 [69]

a. Beeswax, White	60
Spermaceti	70

Stearic Acid	10
b. Peanut Oil	620
c. Borax	5
Benzoic Acid	5
Water	220
d. Perfume	10

Melt *a,* and mix with *b.* Bring to 55°C. on the waterbath, and add the hot solution *c* in small portions with good agitation. When properly emulsified and slightly cooled, add *d.* Stir until cold.

Formula No. 23 [70]

Glycosterin	20
Paraffin Wax	30
Petrolatum White	18
Mineral Oil	8
Water	200
Perfume	To suit

Formula No. 24 [71]

Spermaceti	125
White Wax	120
Liquid Petrolatum	560
Borax	5
Water, Distilled	190

Formula No. 25 [72]

Stearic Acid	4 oz.
Paraffin Wax	½ oz.
Glycerin	12 oz.
Ammonia (26°)	½ oz.

When there is a perfect saponification, add 16 oz. warm distilled water in which must be dissolved 15 g. powdered borax.

Formula No. 26 [73]

White Wax	10 oz.
Paraffin	9 oz.
Ceresin	2 oz.

White Petrolatum	8 oz.
Liquid Petrolatum	3 lb.
Borax	1 oz.
Water, Distilled	1 pt., 4 fl. oz.

Formula No. 27 [74]

Beeswax, White	80
Spermaceti	50
Stearic Acid	20
Lanolin, Anhydrous	20
Borax	5
Benzoic Acid	5
Perfume	9
"Apple Ether"	1
Peanut Oil	540
Water	270

Formula No. 28 [75]

Hard Paraffin Wax	50
Petrolatum, Yellow	400
Peanut Oil	200
Beeswax, Yellow	100
Lanolin, Anhydrous	60
Rosin, Pale	40
Water	140
Borax	10

Formula No. 29 [76]

Parachol (Absorption Base)	125
Peanut Oil	400
Glycerin	200
Water	800

Formula No. 30 [77]

a. Woolfat, Anhydrous, Neutral	40
Petrolatum, White	10
Peanut, Olive, or Sesame Oil	20
b. Glycerin	5
Water	25

Melt *a* on waterbath. Add *b*. Stir till cold.

Perspiration-deodorizing Creams

Formula No. 1[78]

Mannide Monooleate	2
Petrolatum	38
Water	40
Hydrated Aluminium Chloride	20

Formula No. 2[79]

Paraffin Wax	10
Mineral Oil	10
Deomul	15
Petrolatum	5
Aluminum Sulfate	10
Water	50

Heat waxes and oils to 70°C., add 30 parts water. Cool to 45°C., and stir in the aluminum sulfate dissolved in 20 parts water.

Formula No. 3[80]

Polymerized Glycol Stearate	15
Spermaceti	5
Glycerin	3
Aluminum Chloride, Hydrated Crystals	12
Water	To make 100

Formula No. 4[81]

a. Mineral Oil	25
Acimul	25
b. Water	25
c. Oxyquinoline Sulfate (0.1% Solution)	25

Heat *a* till clear. Heat *b* to 75°C. and add to *a*, stirring thoroughly. When the temperature of the mixture is 60°C., *c* is added, with stirring. It is necessary to add *c* in small portions, taking care to make no more additions until the previous portions have been emulsified. Perfume is added. The cream is put into jars at 55°C.

Formula No. 5[82]

Petrolatum, White	9.0
Paraffin, Wax (52°C.)	6.5
Mineral Oil	14.0
Acimul	12.0
Carbitol	3.0
Alum Solution, Saturated	5.5
Rose Water	50.0

Melt the oil and waxes at 70°C. Add them to water, alum solution and Carbitol of the same temperature with good stirring. Stir until just cold enough to be pourable (50°C.). Perfume at 55°C.

Freckle "Preventive"[83]

Quinine Bisulfate	20
Water	477
Amino Stearin	100
Petrolatum, White	200
Mineral Oil	100
Woolfat	100
Perfume Oil	3

Melt the oils and waxes with agitation and add, at about 70°C., the quinine bisulfate-water solution of equal temperature. Stir until cold.

Acid Creams

Formula No. 1[84]

Glycol Distearate, Pure	14.0
Mineral Oil	3.0
White Beeswax	2.0
Ceresin	1.0
Lanolin	1.0
Sodium Lauryl Sulfate	1.0
Citrus Pectin	0.5
Perfume	0.5
Glycerin	6.0

Citric Acid	2.0
Distilled Water	69.0

Formula No. 2[85]

Wool Wax	3.0
Lanolin	8.0
Stearyl Alcohol	2.0
Petrolatum	37.0
Glycerin	4.0
Lactic Acid	1.5
Distilled Water	44.5

Formula No. 3[86]

Five parts of oxy-cholesterin and 95 parts of petrolatum are thoroughly mixed to form an absorption base. Twenty parts of petrolatum and 3 parts of beeswax are melted together, 30 parts of the base are added with thorough stirring. Fifty parts of natural lemon juice are added to the above mass while still hot, and stirring is continued until the mass is cool.

Honey and Almond Type Cream[87]

Cold Cream		½ oz.
Almond Oil		½ oz.
Honey		½ oz.
Boric Acid		1 oz.
Solution of Soda, B.P.		1½ oz.
Quince Mucilage		5 oz.
Water	To make	5 pt.

Mix the cold cream, almond oil, and solution of soda together until a uniform soapy emulsion is obtained. Dissolve the boric acid in 60 oz. of warm water; to this add the glycerin and quince mucilage. Add the mixture slowly, and with constant stirring, to the emulsion. Perfume with spirits of almonds and rose when cold.

Astringent Creams

Formula No. 1[88]

Diglycol Stearate	10
Lanolin Anhydrous	5
Mineral Oil	3
Tannic Acid	2
Water	70

Heat to 170°F. and add to above at that temperature with agitation. Perfume as desired.

Formula No. 2[89]

Paraffin	15
Lanolin	10
Mineral Oil	60
Cetyl Alcohol	15

Heat to 150°F. Then add a heated solution of:

Alum	15
Tannic Acid	15
Water	280

Agitate until the cream congeals.

Avocado Tissue Cream[90]

Avocado Oil	20
Lanolin Absorption Base	10
Stearic Acid	5
Cetyl Alcohol	5
Beeswax	5
Almond Oil	25
Preservative	0.2
Perfume	0.8
Borax	1
Distilled Water	28

The water and borax are brought to a temperature of 165°F. and are then added to the molten fats, oils and waxes. Careful heating and constant stirring are essential, the perfume being added when the temperature has dropped to about 120°F.

Avocado Oil Cleansing Cream[91]

a.	Hydrogenated Oil (Cosmetic Grade)	11.0
	Beeswax U.S.P., White	5.0
	Stearic Acid, Triple Pressed	0.5
	Sesame Seed Oil	60.0
	Avocado Oil	7.0
	Antioxidant and Preservative	0.1
b.	Distilled Water	15.3
	Borax U.S.P.	0.5
c.	Perfume	0.6

Melt *a* at 80°C. Heat *b* to 75°C. When *a* has cooled to 75°C. add *b* with constant stirring. Add *c* at 60°C. Pour between 55°–50°C.

Almond Cream, Liquid[92]

Sweet Almond Oil	1 lb.
Spermaceti	2 lb.
Beeswax	2 lb.
Castile Soap, Powdered	3 lb.
Borax	2 lb.
Quince Jelly	1 lb.
Alcohol	1 pt.
Water	4 pt.

Melt the spermaceti and wax together. Dissolve the soap and borax in hot water. Mix these together and add balance of ingredients. Stir and filter through cloth.

Boro-glycerin Lanolin Cream[93]

Boric Acid	10 g.
Glycerin	40 g.
Water	250 g.
Lanolin, Anhydrous	100 g.
Vaseline, White	600 g.

Rose Oil, Artificial	10 cc.
or Eau de Cologne Oil	20 cc.

Peroxide Cream [94]

a.	Paraffin Wax	4
	Mineral Oil	10
	Lanolin	6
	Acimul	15
b.	Hydrogen Peroxide (100 Volume)	5
c.	Water	60

Heat *a* to 70°C. and stir till completely clear. Heat *c* to 70°C. and add *a* to *c* slowly, stirring in one direction only. At 55°C. add *b* and perfume. Stir and pour at 50°C.

If 5 parts of the water are replaced by 5 parts Carbitol, the cream can be poured at 45°C.

Bleaching Cream [95]

a.	Petrolatum (White)	9
	Paraffin Wax	6.5
	Mineral Oil	14
	Acimul	12
b.	Carbitol	3
	* Lemon Juice	5.5
	Water	50

Part *a* is melted, *b* is mixed, heated to 70–75°C. and poured slowly into *a*, with stirring. Perfume is added at 55°C. The cream is poured at 50°C.

Cholesterol-lecithin Creams

Formula No. 1 [96]

Lanolin, Anhydrous	20
Stearin	10
Cacao Butter	20

---

* Lemon juice can be replaced by citric and lactic acids, etc., in proportionate amounts.

White Wax	20
Sweet Almond Oil, Preserved with Nipagin	200
Cholesterol	6
Lecithin	12
Water	80
Sodium Benzoate	1.5
Borax	15
Nipagin M (Preservative)	0.8

Formula No. 2 [97]

Lanolin, Anhydrous	30
White Wax	50
Spermaceti	10
Borax	2
Water	18
Cholesterol	1.5
Egg Lecithin	0.5

Formula No. 3 [98]

Lanolin (Anhydrous)	12
Water (Distilled)	12
Lecithin	0 5
Cream Petrolatum (Short Fiber)	55.5
Mineral Oil (White)	20
Perfume	To suit

Hormone Cream [99]

a.	Petrolatum	15
	Lanolin, Anhydrous	15
	Absorption Base	10
	Olive Oil	5
	Spermaceti	5
b.	Hormone in Oil	To suit
c.	Water or Rose Water	40
d.	Perfume	

Melt *a* on the water bath. Cool to below 35°C., and add *b*; emulsify with *c*. Perfume last.

Lime and Glycerin Cream [100]

Almond or Peach Kernel Oil	35.00
Glycerin	1.50
Lemon Oil	1.25
Lime Water	To make 80.00

Liquid Lip Make-up [101]

a.	Triethanolamine Oleate	15
	Glycerin	10
	Water	10
b.	Beeswax	10
	Mineral Oil, White	40
	Scarlet, Oil-Soluble	2.5
c.	Perfume (Eau de Cologne Oil, Rose, Fougère)	

Emulsify by adding *b* to *a* at 50–60°C. Stir till cold, and add perfume.

Mascara [102]

Glyceryl Monostearate	10
Triethanolamine	5
Stearic Acid	15
White Petrolatum	20
Beeswax	25
Gelatin	2
Water	13
Carbon Black	10

Make a solution of the gelatin in water, add the triethanolamine. Melt the wax, glyceryl monostearate, petrolatum and stearic acid, add the pigment and then the hot gelatin solution. Mill to get a uniform product.

Moustache Pomade [103]

Glycosterin	4
Gum Arabic	8
Water	31
Castile Soap	12
Beeswax	30
Diethylene Glycol	12
Perfume	To suit

Warm until wax has melted and mix vigorously until uniform.

Absorption Bases

Formula No. 1 [103a]

Cholesterol	3
Cholesterol Stearate	3
Lanolin, Anhydrous	25
Petrolatum, White	69

Heat the petrolatum and lanolin to 150°C., add cholesterol and cholesterol stearate and stir until solution is effected and stir occasionally while cooling.

These bases are reported to emulsify readily with 300% and more of water, and will not show any separation of water when rubbed on the skin.

"Nourishing" Creams

Formula No. 1 [104]

Absorption Base	25
Diglycol Stearate	15
Olive Oil	15
Preservative	1.3
Water	75

Melt absorption base, diglycol stearate, and olive oil, and add to water which has been heated to the melting point temperature of the fat mixture and contains the preservative. Mix well and stir slowly till cool. Incorporate perfume and package.

Formula No. 2 [105]

Mineral Oil, White	35 cc.
Beeswax	20 g.
Amino Stearin	8 g.
Water	50 cc.

Warm together and mix vigorously until emulsified.

Formula No. 3 [106]

Glycosterin	12
Petrolatum	4
Lanolin	6
Mineral Oil	12
Water	65

Formula No. 4 [107]

White Wax	600
Spermaceti	100
Stearin	500
Lanolin, Anhydrous	600
Cacao Butter	400
Sweet Almond Oil (With Preservative)	1800
Cholesterol, Purest	120

After solution of the cholesterol has been effected, stir the following hot solution into the molten mass until pasty:

Sodium Benzoate	15
Borax	100
Water	1700

Formula No. 5 [108]

Beeswax	7
Spermaceti	8
Lanolin Absorption Base	20
Water	50
Mineral Oil	15

Melt the waxes and add the mineral oil. Warm the absorption base and the water to 40°C.; then slowly add the water with steady but not violent agitation. Then add the melted waxes which should be of the same temperature.

Formula No. 6[109]

Lanolin Absorption Base	400
Glycerin	50
Arnica (1:10)	50
Witch Hazel Extract	150
Distilled Water	347
Perfume	3

Formula No. 7[110]

Cetyl Alcohol	50
Lanolin	50
Cocoa Butter	50
Cholesterin	10
White Beeswax	50
Arachis Oil	100
Mineral Oil	150
Petrolatum, White	240
Water	280
Perfume	20

Formula No. 8[111]

Soft Paraffin Containing 1% Oxycholesterol	746
Stearic Acid	20
Triethanolamine	9
Rose Water	225
Perfume	To suit

Formula No. 9[112]

Lanolin	80
Stearic Acid	15
Triethanolamine	5
Water	200

Mix the triethanolamine, the stearic acid and the water. Heat the mixture. When the stearic acid is melted, stir to a creamy soap solution. Add the lanolin and continue heating without stirring until the lanolin is melted. At this point stir the mixture thoroughly until a thick creamy emulsion results. Continue stirring intermittently until the emulsion has cooled to room temperature.

Formula No. 10[113]

1. Diglycol Stearate	14	lb.
2. Mineral Oil	3¾	gal.
3. Lanolin	6	lb.
4. Petrolatum (White)	2	lb.
5. Water	6	gal.
6. Turtle Oil	5½	fl. oz.
7. Perfume Oil	5½	fl. oz.
8. Solution Yellow Color Made by Dissolving Yellow Dye 2 Drams in Mineral Oil 14 Fl. Oz.	8¼	fl. oz.

Melt 1, 2, 3, 4, 6 and 8 at 170°F. and add, with stirring, 5 which has been heated to 180°F. Allow mixer to run until batch is completely emulsified. Allow batch to cool to 125°F. and add 7, and mix at low speed. Batch should be allowed to cool without stirring to 100°F. at which temperature it is poured.

Formula No. 11[114]

White Wax	5	oz.
Spermaceti	1	lb.
Petrolatum (Light Amber)	1	lb.
Mineral Oil	1½	pt.
Lanolin (Hydrous)	2	lb.
Borax	⅜	oz.
Water	10	oz.
Benzyl Alcohol	1	dr.
Bitter Almond Oil	1	dr.
Rose Geranium Oil	1½	dr.
Bergamot Oil	2	dr.

Formula No. 12[115]

a. Spermaceti	10	lb.
Lanolin	20	lb.

	Glycosterin	46 lb.
	Olive Oil	20 lb.
	Almond Oil	30 lb.
b.	Water	90 lb.
	Sodium Benzoate	¼ lb.
c.	Perfume	To suit

Heat *a* to 150°F. and run into it slowly with stirring *b* which has been heated to the same temperature. Add the perfume at about 105°F. Pour at 95–100°F.

Formula No. 13[116]

Absorption Base	30
Lanolin	5
Water	55
Beeswax, White	10

Melt the wax and lanolin, add the base and stir in the water (warm).

Note: Consistency in the foregoing formulas can be adjusted by changing the wax content to suit.

Formula No. 14[117]

Lanolin, Anhydrous	22
Spermaceti	22
Beeswax, White	40
Cocoa Butter, Odorless	28

Formula No. 15[118]

Almond Oil (With preservative)	390
Lecithin	50
Borax	5
Sodium Benzoate	5
Parahydroxybenzoic Acid	2
Water	220

Formula No. 16[119]

Trihydroxyethylamine Stearate	20
Turtle Oil	50
Paraffin Oil (White)	40

Diglycol Stearate	5
Carbitol	20
Water (Distilled)	300
Preservative	5
Perfume Oil	To suit

Melt together the first four of these ingredients, and slowly add the water, which has been heated to 50°C., with constant stirring. Continue stirring untitl cool, and then add Carbitol, containing the perfume and preservative.

Formula No. 17[120]

a.	Hydrogenated Oil	25.6
	Beeswax U.S.P.	9.7
	Lanolin Anhydrous U.S.P.	8.5
	Spermaceti U.S.P.	2.5
	Sesame Seed Oil U.S.P.	36.5
	Preservative and Antioxidant	0.1
b.	Water (Distilled)	15.8
	Borax U.S.P.	0.5
c.	Oleic Acid (White)	0.3
	Perfume	0.5

Melt *a* at 70°C. Bring *b* to same temperature and add to *a* with slow agitation. Add *c* at above 60°C. Pour hot and top.

Formula No. 18[121]

Ti-Tree Oil	10 g.
Lanette Wax SX	10 g.
Mineral Oil	29 g.
Glycerin	1 g.
Water	50 g.

Protective Hand Creams

Formula No. 1[122]

Glyceryl Monostearate	8
Magnesium Stearate	14
Beeswax	3
Petrolatum	10

Mineral Oil	5
Water	60

Heat together to 70°C. and stir until cool.

Formula No. 2[123]

Lanolin (Anhydrous)	20
Paraffin Wax	6
Paraffin Oil	7
Glycol Stearate	12
Water	55

Melt lanolin, glycol stearate, and wax; add oil; then add water while agitating rapidly until cold.

Massage Cream[124]

White Beeswax	20
Spermaceti	20
Peanut Oil	45
Lanolin	12
Water	45
Borax	3
Camphor	1

Melt the wax, add the lanolin and oil, and heat to 80°C. The camphor is dissolved in the oil with gentle heat, the borax is dissolved in the water and heated to 80°C. At this temperature the water is added to the wax-oil mixture at the same temperature with vigorous stirring, best done with a motor stirrer.

Sports Cream[125]

Glycosterin	12
Mineral Oil	10
Cetyl Alcohol	3
Water	100

Heat to 60°C. and mix vigorously till emulsified.

Nail Cream [126]

a.	Beeswax, White	15.0
	Ozokerite, White	2.5
	Montan Wax, Bleached	2.5
	Mineral Oil	60.0
	Cetyl Alcohol	2.0
b.	Water	23.5
	Borax	1.5
c.	Aluminum Stearate	20.0
d.	Fish Silver Paste (10% Dispersed in Amyl Acetate)	5.0 g.

Melt *a*, add *b* which has been heated to about 70°C. Stir thoroughly, add *c*. Stir until the emulsion is almost cold, add *d*.

Mosquito-repelling Cream

Formula No. 1 [127]

a.	Wheat Starch	5
	Water	10
b.	Glycerin (28° Bé.)	45
c.	Lanolin	30
d.	Clove Oil	5–10

Grind *a* until homogeneous, add *b*, and warm gently until a homogeneous jelly is formed. Cool, and grind now with *c* and *d* very thoroughly until distribution is satisfactory. Fill at once into collapsible tubes.

Formula No. 2 [128]

Glyceryl Monostearate	11.0
Oil of Cedar Leaf	4.0
Oil of Pennyroyal	4.0
Linalyl Acetate	3.0
Gasoline	5.0
Menthol	0.5
Phenol	2.0

Glycerin	5.0
Water	65.5

Add the glyceryl monostearate to the water, add the glycerin and bring the mixture to the boiling point with constant stirring. Keep stirring and when the temperature drops to about 45°C. add the rest of the ingredients which have been mixed together.

Formula No. 3 [129]

White Mineral Oil	16	oz.
Beeswax U.S.P.	4	oz.
Spermaceti	1	oz.
Distilled Water	8	oz.
Borax	30	gr.
Butyl Salicylate	1.5	oz.

Antiseptic Cream

Formula No. 1 [130]

Mixed Mono- and Di- Fatty Esters of Polythylene Glycol	10
Stearic Acid	10
Paraffin Wax	15
Mineral Oil	15
Petrolatum	10
Oxy-Quinoline Sulfate	0.2
Water	To make 100

Formula No. 2 [131]

Sulfonated Castor Oil	150
Methyl Salicylate	150
Eucalyptol	45
Menthol	5
Potassium Carbonate	50
Glycerin	100
Water	500

Acriflavine Emulsion [182]

Acriflavine	1 g.
Wool Fat	50 g.
Distilled Water	25 cc.
Liquid Paraffin	925 cc.

Dissolve the acriflavine in the distilled water, heated to about 90°, and add the solution to the anhydrous lanolin in a large warmed mortar. Triturate until a thick cream is produced, then add gradually the liquid paraffin.

White Oil Emulsion [183]

Agar	0.7
Gum Acacia	2.1
Tragacanth	0.3
White Mineral Oil	50.0
Sodium Benzoate	0.2
Flavoring	0.7
Water	46.0

Sunburn Preventive Preparations

Formula No. 1 [184]

Quinine Sulfate	3
White Ceresin Wax	5.5
White Petrolatum	20.5
Mineral Oil	19.5
Lanolin, Anhydrous	15.0
Water	35.5
Cassia Oil	1.0

Heat the water to 70°C. and dissolve the quinine sulphate in it. Melt the ceresin, petrolatum, and lanolin together, stir in the mineral oil, bring the mixture to 65°C. and stir in the quinine solution. Continue stirring until the temperature drops to 45°C. and then add the cassia oil.

Formula No. 2[135]

Quinine Bisulfate	2.5
Cholesterin Absorption Base	25.5
Mineral Oil	12.5
Alcohol	10.0
Water	49.5
Perfume	0.5

Formula No. 3[136]

a. Triethanolamine	40
Trihydroxyethylamine Stearate	40

Melt on water bath, make emulsion in

Water (60°C.)	620–630
b. Paraffin Oil	100
Peanut Oil	150
Oleic Acid	30

Warm up on water bath to 40°C.

Methyl-*p*-Hydroxy Benzoate	1

Pour *b* into *a,* perfume with

c. Perfume Oil	To suit

Stir until cold.

Sunburn Healing Preparation[137]

Tincture of Benzoin	4
Borax	4
Olive Oil	40
Lime Water	52

Dissolve the borax in the lime water; add the olive oil with rapid agitation. When an emulsion is formed add the tincture of benzoin.

Burn Emulsions

Formula No. 1 [138]

Tragacanth	1– 1.5
Tannic Acid	1– 5
Polyisobutylene	5–10
White Oil	30–40
Benzocaine	1– 2
Glycerin	5–10
Water	40–50

Formula No. 2 [139]

Cetyl Trimethyl Ammonium Bromide	1.0
Sulfanilamide	3.0
Castor Oil	25.0
Beeswax	1.8
Wool Fat	1.8
Cetyl Alcohol	5.0
Glycerin	10.0
Water	52.4

Melt the castor oil, beeswax and wool fat and cetyl alcohol at as low a temperature as possible. Dissolve the cetyl trimethyl ammonium bromide in the water with the aid of heat and mix with the oil, etc., at about 60°C. and stir till set. The sulfanilamide is then rubbed up with the glycerin and incorporated, with thorough mixing, in the cream.

Hair Creams

Formula No. 1 [140]

Cholesterin	2
White Petrolatum	10
Lanolin	10
White Mineral Oil	50
Water	100

The lanolin may be replaced by deodorized arachis oil and beeswax (1:5). It is necessary to use a homogenizer in the preparation of such a cream.

Formula No. 2[141]

Gum Tragacanth (Pulv.)	1.5
Castor Oil	8.0
Glucose	8.0
Alcohol	14.0
Sodium Benzoate	0.2
Formaldehyde	0.4
Water	To make 160.0
Perfume	Sufficient

Formula No. 3[142]

Gum Tragacanth (Pulv.)	1.5
Castor Oil	4.0
Glycerin	8.0
Alcohol	14.0
Sodium Benzoate	0.2
Formaldehyde	0.4
Water	To make 160.0
Perfume	Sufficient
Mineral Oil	48.0

Formula No. 4[143]

Powdered Soap	50
Water	36
Glycerin	18

Dissolve the soap in hot water, add the glycerin. While stirring well add

Peanut Oil	40

Mix until homogeneous and add

Perfume	12

and continue stirring until nearly cool. To get maximum stability, run through a colloid mill.

Hair Milk

Formula No. 1 [144]

Glyceryl Monostearate	6
Liquid Paraffin	30
Distilled Water	64
Perfume	To suit

Formula No. 2 [145]

a. Mineral Oil, White	144
b. Trihydroxyethylamine Stearate	29
c. Water, Warm	320
d. Perfume	3

While stirring heat *a* and *b* until melted together. Add *c* slowly with stirring until uniform. Add *d*. Stir. Allow to stand overnight, stir moderately and package.

Formula No. 3 [146]

Triethanolamine Stearate	7
Spermaceti	3
Liquid Paraffin	25
Distilled Water	65
Perfume	To suit

Dissolve the trihydroxyethylamine stearate and spermaceti in the liquid paraffin over a water-bath. While still warm run in the water previously warmed. Stir vigorously until quite homogeneous and cool, working in the perfume as the cream cools.

Milky Hair Wash [147]

a. Trihydroxyethylamine Stearate Special	10
b. Kerosene	150
c. Pine Oil	6
d. Water	250

Heat *a* and *b* to 140°F. and stir until dissolved; then stir in *c*. Now allow *d* to run in slowly while stirring. If the pine oil is objectionable, any other oil may be substituted for it. It may be colored by means of any water-soluble dye free from salt.

Soapless Shampoo [148]

Sulfonated Olive Oil, Concentrated	40
Sulfonated Castor Oil, Concentrated	10
White Mineral Oil	15
Water	35
25% Solution of Caustic Soda	To clear

Mix all the ingredients with the exception of the caustic soda, warm to 45–50°C. and add the caustic soda solution (1 or 2%) until the mixture turns bright. Add perfume as desired.

Hair Tonic [149]

Cholesterol	10
Mineral Oil	50
Sodium Choleate	5
Glycerin	50

Heat the cholesterol and mineral oil to 130°F. and add to the other ingredients slowly with agitation.

Then add slowly with agitation a solution of

Borax	5
Water	1000

which has been heated to 130°F. Stir until cold.

Pine Oil Emulsions

Formula No. 1 [150]

a. Pine Needle Oil	10
b. Sodium Sulforicinoleate	10
c. Water	5
d. Fluorescein	To suit

Mix *a* and *b* until dissolved. Add *c* slowly with stirring. Add *d* and stir until dissolved.

Formula No. 2[151]

Turkey Red Oil	10
Fluorescein	1/10
Pine Oil	3
Water	3

Dissolve the fluorescein in the Turkey red oil; add the pine oil and when well mixed add the water, stirring until a uniform liquid results. Strain if necessary.

Formula No. 3[152]

Cocoanut Oil (Saponification No. 257)	160.0
Potassium Hydroxide (89%)	46.0
Pine Oil	40.0
Water	754.0

Cocoanut oil of Ceylon grade is heated to a temperature of 80°–85°C. The potassium hydroxide is then dissolved in a sufficient amount of the water to make a 15% to 20% solution. One-half of the solution is then added to the cocoanut oil and stirred in slowly. The balance of water is then added followed by the balance of potassium hydroxide solution which is stirred in slowly. The temperature of the mix is then kept at 80°–85°C. for a period of from two to three hours with good agitation. After complete saponification, the solution is then cooled, chilled and filtered in this chilled state. The pine oil is then added with very slow stirring. A sufficient amount of water is then added to balance water loss during sustained heating to bring product to original weight.

Formula No. 4[153]

Mixed Oleic Acid Esters of Polyglycol	10
Pine Oil	40
Diglycol Monooleate	7
Oxalic Acid	2
Water	41

Solidified Perfume [154]

Trihydroxyethylamine Linoleate	1
Orange or Other Oil	1
Water	1

Add in above order, stirring well.

Water-Soluble Perfumes [155]

(Jellified Perfumes)

a. Trihydroxyethylamine Linoleate #297	1
b. Perfume	1
c. Water	½–1

Mix *a* and *b* together until uniform. Add *c* slowly, with stirring, until a jelly is formed. The water must be added very slowly, with thorough stirring, but as soon as a turbidity appears no more water may be added. These jelly perfumes disperse in water to give a milky solution when concentrated and a slightly turbid solution when highly diluted. By incorporating medicinal ingredients, ointments, salves, etc., can be made which are not sticky and wash off readily with water.

Shaving Creams

Formula No. 1 [156]

Glycosterin	10
Ethylene Glycol	10
White Mineral Oil	8
Lanolin	2
Stearic Acid	34
Glycerin	2

Formula No. 2 [157]

a. Mineral Oil	10
b. Glycosterin	10
c. Water	50

Heat *a* and *b* to 150°F. and stir into it slowly *c* heated to 150°F. A little perfume and menthol (if desired) is stirred in at 105°F. and stirring is continued until cold.

Formula No. 3[158]

Stearic Acid	12
White Mineral Oil	12
Paraffin Wax	5
Soap Flakes	3
Water	72

Formula No. 4[159]

Stearic Acid	16.5
Lanolin	1.0
Raisin Seed Oil	8.5
Triethanolamine	1.0
Water	72.5
Perfume	0.5

Formula No. 5[160]

Glyceryl Monostearate	6.5
Stearic Acid	6.5
Mineral Oil	4.0
Peanut Oil	4.0
Glycerin	10.0
Water	69.0

Formula No. 6[161]

Stearic Acid	25.0
Coconut Oil	8.0
Arlex	3.5
Boric Acid	1.5
Potassium Hydroxide (42° Bé.)	18.0
Sodium Hydroxide (42° Bé.)	2.5
Water	39.0
Olive Oil	2.0
Cetyl Alcohol	1.0
Menthol Crystals	0.22

The stearic acid and oils are mixed and heated to 212°F. At this point the alkali, also heated to the same temperature, is slowly added with stirring. The mixture is then held at 210°F. for 16 hours and stirred every 3 or 4 hours during this time. Next, the boric acid dissolved in half the water content is added at 212°F. and mixed. Finally, the remaining constituents mixed with water at 212°F. are added and the composition is stirred slowly while cooling.

Disinfectant Emulsions

Formula No. 1[162]

Sulfonated Castor Oil	100
Caustic Soda (36° Bé.)	51.2

Heat at 80–100°C., then add

Rosin	104

Mix with heating, until uniform and add

Tar Oils (200–320°C.)	775

Mix until dissolved and then add

Water	To make 1000

Formula No. 2[163]

Cresol	35
Creosote	45
Castor Oil Soap	20
Water	To suit

Formula No. 3[164]

Rosin	17
Washed Creosote	71
Cresol	10
Caustic Soda	2
Water	2

Formula No. 4[165]

Cresol	50.0
Creosote	7.5
Glue	2.5

Castor Oil Soap	0.5
Caustic Soda	0.1
Water	60.0

Formula No. 5[166]

Cresol	50	cc.
Linseed Oil	17	g.
Oleic Acid	1	g.
Potassium Hydroxide	4.2	g.
Distilled Water	To 100	cc.

The oil and acid are heated to the maximum temperature of the water-bath and a solution of the potassium hydroxide in 25 mils. of water, heated nearly to boiling, is added.

Formula No. 6[167]

A very satisfactory disinfectant is a mixture of equal parts of cresol and Turkey red oil.

Formula No. 7[168]

Cresylic Acid	100
Linseed Oil	100
Caustic Potash Solution (33⅓%)	75
Alcohol	6

Formula No. 8[169]

Tar Oil Acids	40
Rosin	10
Caustic Potash Solution (33⅓%)	70
Alcohol	70

Formula No. 9[170]

Cresylic Acid or Cresol	50
Sulfonated Castor Oil (50%)	24
Red Oil or Oleic Acid	7
Sodium or Potassium Hydroxide	1
Water	18

Mix the red oil and cresol warm. Dissolve the hydroxide in the water, warming if necessary. Mix these two solutions and add the sulfonated castor oil.

Formula No. 10[171]

Tar Acid Oil	66.00
Rosin	20.00
Caustic Soda (25% Solution)	10.30
Water	3.70

Formula No. 11[172]

Light Coal Tar Oil (Sp. Gr. about 1.02 at 60°F.)	69.4
Rosin (Grade F)	18.4
Caustic Soda Solution (Sp. Gr. 1.3)	9.6
Water	2.6

This formula is stated in percentages by weight.

Melt rosin and add oil, mix well. Add soda and mix. Add the water.

Formula No. 12[173]

Tar Acids	75
Oil Soluble Mineral Oil Sulfonate	11
Mineral Oil	4
Isopropyl Alcohol	10

Pine Oil Disinfectant

Formula No. 1[174]

Pine Oil	60
Naphthenic Soap	25
Sulfonated Castor Oil	15

Formula No. 2[175]

Pine Oil	57.00
Rosin	25.00
Caustic Potash (25% Solution)	8.50
Glucose	1.00
Water	8.50

The caustic potash and water are mixed and heated. When boiling, the rosin is added slowly and the heating is continued for one hour, taking care to stir mixture occasionally; the pine oil is added and the heating is continued until a sample that has been withdrawn and poured into water does not show separation of oil. When the test is satisfactory the heat is removed and the glucose is added.

For use add 1 oz. to a gallon of water.

Formula No. 3[176]

Pine Oil	63
Soap	29
Water	8

Formula No. 4[177]

Raw Pine Oil	60
Sulfonated Castor Oil (50%)	30
Red Oil or Oleic Acid	9
Potassium Hydroxide (Solid)	1

Mix the pine oil and the sulfonated castor together. Then add the red oil and dissolve the potassium hydroxide in the mixed oils.

Formula No. 5[178]

Rosin Soap	10
Pine Oil	60

The pine oil is worked into the soap, gradually to avoid lumping. Part of the pine oil may be replaced by kerosene to lower costs. The above when stirred into water gives a milky white emulsion.

Formula No. 6[179]

Phenol	1
Pine Oil	5
Sulfonated Olive Oil (30%)	16
Water	78

Formula No. 7[180]

Oleic Acid (Acid Number 194)	61.6
"I" Wood Rosin (Acid Number 165)	61.6
Sodium Hydroxide (100%)	16.3

Yarmor Pine Oil	133.0
Tri-sodium Phosphate	26.7
Water	700.8

Antiseptic Emulsion

Formula No. 1 [181]

Oil-soluble Mineral Oil Sulfonate	11
Thymol	5
Eucalyptol	5
Isopropyl Alcohol	20
Kerosene	59

Liquid-petrolatum Emulsion [182]

Liquid Petrolatum	500	cc.
Mannitan Monostearate	0.5	g.
Sugar Syrup	100	cc.
Vanillin	0.040	g.
Alcohol	60	cc.
Distilled Water	To make 1000	cc.

Dissolve the mannitan monostearate in the oil by warming and add the other ingredients. Emulsification takes place immediately. No special care is required to insure a permanent, stable emulsion.

Air-odor Neutralizer [183]

(Wick Type)

Siberian Fir Needle Oil	40
Wintergreen Oil	5
Clove Oil	5
Spearmint Oil	5
Sassafras Oil	5

This mixture of oils is then combined with the emulsifying agent to form the following concentrate:

Above Oil Mixture	50
Sulfonated Oil (Emulsifying Agent)	50

This concentrate may be stored until needed. To use it, it is diluted in the following proportions:

Concentrate	40
Distilled Water	200

REFERENCES

[1] Bennett, Chem. Formulary, Vol. 4, p. 52 (1939).
[2] Bennett, Chem. Formulary, Vol. 4, p. 52 (1939).
[3] Bennett, Chem. Formulary, Vol. 4, p. 49 (1939).
[4] Bennett, Chem. Formulary, Vol. 4, p. 49 (1939).
[5] Bennett, Chem. Formulary, Vol. 5, p. 61 (1941).
[6] Bennett, Chem. Formulary, Vol. 2, p. 146 (1939).
[8] Bennett, Chem. Formulary, Vol. 2, p. 147 (1935).
[9] Bennett, Chem. Formulary, Vol. 3, p. 76 (1936).
[10] Bennett, Chem. Formulary, Vol. 2, p. 136 (1935).
[11] Bennett, Chem. Formulary, Vol. 2, p. 144 (1935).
[12] Bennett, Chem. Formulary, Vol. 6.
[13] Bennett, Chem. Formulary, Vol. 1, p. 109 (1933).
[14] Bennett, Chem. Formulary, Vol. 4, p. 59 (1939).
[15] Bennett, Chem. Formulary, Vol. 2, p. 144 (1935).
[16] Bennett, Chem. Formulary, Vol. 2, p. 145 (1935).
[17] Bennett, Chem. Formulary, Vol. 1, p. 122 (1933).
[18] Bennett, Chem. Formulary, Vol. 2, p. 144 (1935).
[19] Bennett, Chem. Formulary, Vol. 2, p. 144 (1939).
[20] Bennett, Chem. Formulary, Vol. 1, p. 123 (1933).
[21] Bennett, Chem. Formulary, Vol. 4, p. 56 (1939).
[22] Bennett, Chem. Formulary, Vol. 4, p. 55 (1939).
[23] Bennett, Chem. Formulary, Vol. 4, p. 49 (1939).
[24] Bennett, Chem. Formulary, Vol. 4, p. 54 (1939).
[24a] Bennett, Chem. Formulary, Vol. 4, p. 59 (1939).
[25] Bennett, Chem. Formulary, Vol. 5, p. 62 (1941).
[26] Bennett, Chem. Formulary, Vol. 5, p. 62 (1941).
[27] Bennett, Chem. Formulary, Vol. 5, p. 62 (1941).
[28] Bennett, Chem. Formulary, Vol. 5, p. 62 (1941).
[29] Bennett, Chem. Formulary, Vol. 1, p. 153 (1933).
[30] Bennett, Chem. Formulary, Vol. 1, p. 162 (1933).
[31] Bennett, Chem. Formulary, Vol. 3, p. 66 (1936).
[32] Bennett, Chem. Formulary, Vol. 1, p. 106 (1933).
[33] Bennett, Chem. Formulary, Vol. 1, p. 106 (1933).
[34] Bennett, Chem. Formulary, Vol. 2, p. 133 (1935).
[35] Bennett, Chem. Formulary, Vol. 1, p. 10 (1933).
[36] Bennett, Chem. Formulary, Vol. 1, p. 106 (1933).
[37] Kalish, Drug & Cosmetic Industry, *48*, 36 (1941).
[38] Bennett, Chem. Formulary, Vol. 4, p. 49 (1939).
[39] Bennett, Chem. Formulary, Vol. 2, p. 146 (1935).
[40] Atlas Powder Co., Wilmington, Del.

[41] Atlas Powder Co., Wilmington, Del.
[42] Atlas Powder Co., Wilmington, Del.
[43] Atlas Powder Co., Wilmington, Del.
[44] Atlas Powder Co., Wilmington, Del.
[45] Atlas Powder Co., Wilmington, Del.
[46] Bennett, Chem. Formulary, Vol. 3, p. 65 (1936).
[47] Kalish, Drug & Cosmetic Industry, *48*, 36 (1941).
[48] Bennett, Chem. Formulary, Vol. 3, p. 67 (1936).
[49] Bennett, Chem. Formulary, Vol. 1, p. 108 (1933).
[50] Goldschmidt, U. S. 2,269,529 (1942).
[51] Personal Communication.
[52] Kalish, Drug and Cosmetic Industry, *48*, 36 (1941).
[53] Bennett, Chem. Formulary, Vol. 1, p. 109 (1933).
[54] Bennett, Chem. Formulary, Vol. 4, p. 48 (1939).
[55] Bennett, Chem. Formulary, Vol. 3, p. 65 (1936).
[56] Bennett, Chem. Formulary, Vol. 1, p. 109 (1933).
[57] Bennett, Chem. Formulary, Vol. 3, p. 65 (1939).
[58] Atlas Powder Co., Wilmington, Del.
[59] Bennett, Chem. Formulary, Vol. 1, p. 108 (1933).
[60] Goldschmidt, U. S. 2,269,529 (1942).
[61] Bennett, Chem. Formulary, Vol. 4, p. 49 (1939).
[62] Kalish, Drug and Cosmetic Industry, *48*, 36 (1941).
[63] Kalish, Drug and Cosmetic Industry, *48*, 36 (1941).
[64] Bennett, Chem. Formulary, Vol. 1, p. 107 (1933).
[65] Bennett, Chem. Formulary, Vol. 1, p. 107 (1933).
[66] Bennett, Chem. Formulary, Vol. 1, p. 107 (1933).
[67] Bennett, Chem. Formulary, Vol. 1, p. 109 (1933).
[68] Bennett, Chem. Formulary, Vol. 2, p. 147 (1935).
[69] Bennett, Chem. Formulary, Vol. 4, p. 48 (1939).
[70] Bennett, Chem. Formulary, Vol. 1, p. 108 (1933).
[71] Bennett, Chem. Formulary, Vol. 1. p, 109 (1933).
[72] Bennett, Chem. Formulary, Vol. 1. p, 109 (1933).
[73] Bennett, Chem. Formulary, Vol. 1, p. 108 (1933).
[74] Bennett, Chem. Formulary, Vol. 4, p. 48 (1939).
[75] Bennett, Chem. Formulary, Vol. 4, p. 49 (1939).
[76] Bennett, Chem. Formulary, Vol. 4, p. 56 (1939).
[77] Bennett, Chem. Formulary, Vol. 4, p. 51 (1939).
[78] Atlas Powder Co., Wilmington, Del.
[79] Bennett, Chem. Formulary, Vol. 5, p. 58 (1941).
[80] Glyco Products Co., Inc., Brooklyn, N. Y.
[81] Bennett, Chem. Formulary, Vol. 4, p. 53 (1939).
[82] Bennett, Chem. Formulary, Vol. 4, p. 54 (1939).
[83] Bennett, Chem. Formulary, Vol. 4, p. 56 (1939).
[84] Bennett, Chem. Formulary, Vol. 5, p. 59 (1941).
[85] Bennett, Chem. Formulary, Vol. 5, p. 59 (1941).
[86] Bennett, Chem. Formulary, Vol. 3, p. 70 (1936).
[87] Bennett, Chem. Formulary, Vol. 2, p. 146 (1935).
[88] Bennett, Chem. Formulary, Vol. 2, p. 148 (1935).
[89] Bennett, Chem. Formulary, Vol. 2, p. 148 (1935).
[90] Bennett, Chem. Formulary, Vol. 4, p. 50 (1939).

[91] Bennett, Chem. Formulary, Vol. 4, p. 49 (1939).
[92] Bennett, Chem. Formulary, Vol. 1, p. 105 (1933).
[93] Bennett, Chem. Formulary, Vol. 2, p. 70 (1935).
[94] Bennett, Chem. Formulary, Vol. 4, p. 52 (1939).
[95] Bennett, Chem. Formulary, Vol. 4, p. 52 (1939).
[96] Bennett, Chem. Formulary, Vol. 1, p. 104 (1933).
[97] Bennett, Chem. Formulary, Vol. 1, p. 104 (1933).
[98] Bennett, Chem. Formulary, Vol. 3, p. 68 (1936).
[99] Bennett, Chem. Formulary, Vol. 4, p. 53 (1939).
[100] Bennett, Chem. Formulary, Vol. 5, p. 59 (1941).
[101] Bennett, Chem. Formulary, Vol. 4, p. 54 (1939).
[102] Bennett, Chem. Formulary, Vol. 5, p. 63 (1941).
[103] Bennett, Chem. Formulary, Vol. 4, p. 66 (1939).
[103a] Bennett, Chem. Formulary, Vol. 7, p. 85 (1945).
[104] Bennett, Chem. Formulary, Vol. 2, p. 146 (1935).
[105] Glyco Products Co., Inc., Brooklyn, N. Y.
[106] Bennett, Chem. Formulary, Vol. 1, p. 112 (1933).
[107] Bennett, Chem. Formulary, Vol. 1, p. 112 (1933).
[108] Bennett, Chem. Formulary, Vol. 2, p. 147 (1935).
[109] Bennett, Chem. Formulary, Vol. 4, p. 52 (1939).
[110] Bennett, Chem. Formulary, Vol. 4, p. 52 (1939).
[111] Bennett, Chem. Formulary, Vol. 4, p. 53 (1939).
[112] Bennett, Chem. Formulary, Vol. 1, p. 104 (1933).
[113] Bennett, Chem. Formulary, Vol. 3, p. 70 (1936).
[114] Bennett, Chem. Formulary, Vol. 1, p. 112 (1933).
[115] Bennett, Chem. Formulary, Vol. 1, p. 112 (1933).
[116] Bennett, Chem. Formulary, Vol. 1, p. 113 (1933).
[117] Bennett, Chem. Formulary, Vol. 1, p. 112 (1933).
[118] Bennett, Chem. Formulary, Vol. 1, p. 113 (1933).
[119] Personal Communication.
[120] Bennett, Chem. Formulary, Vol. 4, p. 50 (1939).
[121] Bennett, Chem. Formulary, Vol. 5, p. 59 (1941).
[122] Bennett, Chem. Formulary, Vol. 2, p. 146 (1935).
[123] Glyco Products Co., Inc., Brooklyn, N. Y.
[124] Bennett, Chem. Formulary, Vol. 2, p. 149 (1935).
[125] Bennett, Chem. Formulary, Vol. 4, p. 53 (1939).
[126] Bennett, Chem. Formulary, Vol. 4, p. 67 (1939).
[127] Bennett, Chem. Formulary, Vol. 3, p. 68 (1936).
[128] Bennett, Chem. Formulary, Vol. 2, p. 363 (1935).
[129] Bennett, Chem. Formulary, Vol. 1, p. 111 (1933).
[130] Goldschmidt, U. S. 2,269,529 (1942).
[131] Bennett, Chem. Formulary, Vol. 2, p. 157 (1935).
[132] Bennett, Chem. Formulary, Vol. 2, p. 371 (1935).
[133] Bennett, Chem. Formulary, Vol. 2, p. 371 (1935).
[134] Bennett, Chem. Formulary, Vol. 2, p. 150 (1935).
[135] Bennett, Chem. Formulary, Vol. 2, p. 150 (1935).
[136] Bennett, Chem. Formulary, Vol. 3, p. 98 (1936).
[137] Bennett, Chem. Formulary, Vol. 2, p. 153 (1935).
[138] Bennett, Chem. Formulary, Vol. 7, p. 97 (1945).
[139] Bennett, Chem. Formulary, Vol. 7, p. 97 (1945).

[140] Bennett, Chem. Formulary, Vol. 4, p. 66 (1939).
[141] Bennett, Chem. Formulary, Vol. 2, p. 161 (1935).
[142] Bennett, Chem. Formulary, Vol. 2, p. 161 (1935).
[143] Bennett, Chem. Formulary, Vol. 4, p. 66 (1939).
[144] Bennett, Chem. Formulary, Vol. 4, p. 63 (1939).
[145] Bennett, Chem. Formulary, Vol. 1, p. 147 (1933).
[146] Bennett, Chem. Formulary, Vol. 4, p. 63 (1939).
[147] Bennett, Chem. Formulary, Vol. 1, p. 119 (1933).
[148] Bennett, Chem. Formulary, Vol. 1, p. 119 (1933).
[149] Bennett, Chem. Formulary, Vol. 2, p. 163 (1935).
[150] Bennett, Chem. Formulary, Vol. 1, p. 102 (1933).
[151] Bennett, Chem. Formulary, Vol. 1, p. 101 (1933).
[152] Personal Communication.
[153] Goldschmidt, U. S. 2,269,529 (1942).
[154] Bennett, Chem. Formulary, Vol. 1, p. 126 (1933).
[155] Bennett, Chem. Formulary, Vol. 1, p. 127 (1933).
[156] Bennett, Chem. Formulary, Vol. 1, p. 131 (1933).
[157] Bennett, Chem. Formulary, Vol. 1, p. 131 (1933).
[158] Bennett, Chem. Formulary, Vol. 1, p. 129 (1933).
[159] Bennett, Chem. Formulary, Vol. 4, p. 73 (1939).
[160] Bennett, Chem. Formulary, Vol. 1, p. 129 (1933).
[161] Atlas Powder Co., Wilmington, Del.
[162] Bennett, Chem. Formulary, Vol. 3, p. 103 (1936).
[163] Bennett, Chem. Formulary, Vol. 1, p. 150 (1933).
[164] Bennett, Chem. Formulary, Vol. 1, p. 150 (1933).
[165] Bennett, Chem. Formulary, Vol. 1, p. 150 (1933).
[166] Bennett, Chem. Formulary, Vol. 2, p. 273 (1935).
[167] Bennett, Chem. Formulary, Vol. 4, p. 91 (1939).
[168] Bennett, Chem. Formulary, Vol. 4, p. 91 (1939).
[169] Bennett, Chem. Formulary, Vol. 4, p. 91 (1939).
[170] Bennett, Chem. Formulary, Vol. 2, p. 273 (1935).
[171] Bennett, Chem. Formulary, Vol. 2, p. 273 (1935).
[172] Bennett, Chem. Formulary, Vol. 2, p. 273 (1935).
[173] Schuler, U. S. 2,228,407 (1941).
[174] Bennett, Chem. Formulary, Vol. 4, p. 91 (1939).
[175] Bennett, Chem. Formulary, Vol. 2, p. 273 (1935).
[176] Bennett, Chem. Formulary, Vol. 4, p. 91 (1939).
[177] Bennett, Chem. Formulary, Vol. 2, p. 273 (1935).
[178] Bennett, Chem. Formulary, Vol. 1, p. 150 (1933).
[179] Bennett, Chem. Formulary, Vol. 4, p. 92 (1939).
[180] Hercules Powder Co., Wilmington, Del.
[181] Schuler, U. S. 2,228,407 (1941).
[182] Bennett, Chem. Formulary, Vol. 7, p. 106 (1945).
[183] Bennett, Chem. Formulary, Vol. 7, p. 109 (1945).

CHAPTER XIX

DEFOAMING AGENTS

OCTYL alcohol is used as a defoaming agent as follows (suggested concentrations are by volume unless otherwise indicated):

(a) Oil, where foaming is due to presence of water, use 0.0005%.
(b) Varnish inks, use 0.001–0.01%.
(c) Beet sugar, use 0.0005–0.005% of solution.
(d) Paper, use 0.0005–0.005% of pulp.
(e) Analytical procedure; such as analyses of fruit juices, powdered milk, petroleum-water mixtures, etc., use a few drops in 500 cc.
(f) Photographic film developing solutions, spray 1 to 10 oz. for 200 gal. of foam.
(g) Textile printing, use 0.25–1.5% of paste.
(h) Chemical Processes (manufacture dyes, alum, etc.) use 0.1–1.0%.
(i) Wire drawing soap lubricants, use 0.01–0.1%.
(j) Asphalt emulsions, use 0.001–0.01%.
(k) Eliminating air bubbles and "pin holes" in gelatin glue spreading, use 0.1–1.0%.

Where the odor of octyl alcohol is objectionable the proprietary defoamer Foamex is used similarly to the above.[1]

Defoaming and Defrothing Agents

Formula No. 1[2]

Five parts of aluminum stearate are dissolved in 95 parts of pine oil to give a substantially clear fluid solution.

Formula No. 2[3]

Five parts of aluminum stearate are dissolved in a mixture of 78.75 parts of pine or eucalyptus oil and 26.25 parts of a mixture of higher alcohols.

The addition of 1% or less of Formula 1 or 2 to a solution of 10 parts of glue and 10 parts of dextrin in 100 parts of water completely prevents the development of foam or froth when the mixture is shaken.

Formula No. 3[4]

Five parts of zinc stearate are dissolved in 95 parts of pine oil at 95–100°C.

Formula No. 4[5]

Three parts of calcium oleate are dissolved in 97 parts of pine oil at 95–100°C.

The addition of 0.25% of either of Formula 3 or Formula 4 to a solution of 10 parts of glue and 10 parts of dextrin in 100 parts of water considerably reduces the amount of foam formed when the mixture is shaken as compared with the amount normally formed.

When 0.25% of pine oil alone is added, the amount of froth formed is also sensibly reduced but still remains about double that formed according to the above process.

Formula No. 5[6]

Five parts of barium stearate are dissolved in 95 parts of oleic acid at 95–100°C.

The addition of 0.25% of this agent to glue-dextrine solutions reduces the froth formed on shaking to half the amount formed when 0.25% of oleic acid alone has been added.

Radiator Anti-foaming Agent[7]

Water	1000
Montan Wax	8
Potassium Hydroxide	12

REFERENCES

[1] Bennett, Chem. Formulary, Vol. 4, p. 100 (1939).
[2] Bennett, Chem. Formulary, Vol. 2, p. 183 (1935).
[3] Bennett, Chem. Formulary, Vol. 2, p. 183 (1935).
[4] Bennett, Chem. Formulary, Vol. 2, p. 183 (1935).
[5] Bennett, Chem. Formulary, Vol. 2, p. 183 (1935).
[6] Bennett, Chem. Formulary, Vol. 2, p. 183 (1935).
[7] Flaxman, U. S. 2,127,490 (1938).

CHAPTER XX

FOOD EMULSIONS

Butterscotch Icing[1]

Boil to 245°F..

Brown Sugar	8 lb.
Butter	4 lb.
Water	4 pt.
Salt	2 oz.

Now cream up lightly

Powdered Sugar	25 lb.
Shortening	5 lb.
Liquid Skimmed Milk	2 pt.

Into this creamed mass, add the hot butterscotch syrup and whip up to the desired consistency.

Chocolate Milk, Stabilized[2]

Sodium Alginate	0.8 lb.
Irish Moss	0.7 lb.
Sugar	44.0 lb.
Cocoa	8.8 lb.
Milk	96.0 gal.

Cocoa Icing[3]

Cocoanut Butter	16
Invert Sugar	20
Water	12
Cocoa	20
Icing Sugar	88
Milk Powder	4¾

Salt	⅛
Vanilla	½

Beat together until smooth and glossy.

Artificial Cream

Formula No. 1[4]

Butter, Unsalted	2	lb.
Milk	2	pt.
Sugar	½	oz.
Sodium Alginate	⅙	oz.

Warm the milk and butter together to 100°F., add the sugar and sodium alginate and stir thoroughly until dissolved. Homogenize without the addition of further heat and without allowing the mixture to cool.

Formula No. 2[5]

Butter Fat	19.00
Vegetable Fat	10.00
Milk Powder	7.00
Sugar	0.75
Gelatin	1.00
Borax	0.25
Water	62.00
Flavor	To suit

Formula No. 3[6]

To produce a 32%-fat synthetic whipping cream, use 1 lb. 10 oz. of emulsifying-type shortening, 2 lb. 15 oz. water, 8 oz. dry milk solids and not over 1.5% fat.

To produce a half-and-half cream made from half uncultured butter and half emulsifying-type shortening, use 1 lb. 14 oz. butter, 1 lb. 10 oz. emulsifying-type shortening, 1 lb. dry milk solids, not over 1.5% fat, 5 lb. 9 oz. fresh water.

Synthetic "Cream" for Confectionery[7]

As an example, a whale oil is used which has been hydrogenated until its melting point is about 30°C. A blend is made from 10 lb. of this hardened fat, 5 lb. of buttermilk, 1.5 lb.

sugar and 12 oz. of glycerin. The resulting emulsion is stirred thoroughly with the introduction of air, to form a creamy product.

Cheese-, Ice-cream- and Salad-Stabilizer[8]

Locust Bean Gum	65
Irish Moss, Powdered	35
Karaya Gum	15

When used in the preparation of cream cheese, the undiluted mixture of the three ingredients mentioned above is added when the curds are mixed with the cream in the proportion of about 0.5% by weight on a wet basis. The material is heated to about 165°F., homogenized, and then packed hot.

In ice cream, used diluted with sugar in the preferred proportion of 0.5% on a wet basis, the stabilizer prevents crystallization of ice particles and insures a fine, smooth texture.

Dairy Product-Stabilizer[9]

Select Irish Moss (Pulverized)	20 lb.
Ordinary Irish Moss (Pulverized)	20 lb.
Glyceryl Monostearate	9 lb.
Tri-Sodium Phosphate	8 oz.

The two grades of Irish moss, the glyceryl monostearate, and the tri-sodium phosphate are heated with 10 times their weight of water in a mixing kettle. Preferably, the heating is done by direct steam injection which adds to the moisture content and also serves as an agitator to insure a complete mixture of the ingredients. The temperature is brought to the boiling point and held there for approximately 30 minutes, during which time the steam circulates through the batch, the odor of the Irish moss being carried off in the escaping steam.

The batch is then pumped to an atmospheric double drum drier or its equivalent, and all but approximately 1–6% of its moisture content is removed.[9]

Infants' Milk (Synthetic)[10]

Sugar	40
Soya-Bean Powder	125
Lactose	30
Peanut Oil	20
Dextrin	20
Egg Yolk, Liquid	50
Calcium Lactate	6
Salt	2

Stir in water before use.

Lemon Oil Emulsions

Formula No. 1[11]

Gum Tragacanth	18 oz.
Glycerin	1 qt.
Water	4 gal.
Lemon Oil	4 qt.

Place the gum tragacanth in a kettle similar to a baker's mixing machine. Pour the water over it, stir well and whip until all the lumps have disappeared. Let stand overnight.

Next morning, squeeze the gum solution through a cheesecloth bag. Add the glycerin to the homogeneous gum solution. Mix for 5 minutes at slow speed.

Put the machine in second speed and gradually add the lemon oil.

After 1 qt. of oil has been added, it is advisable to put the machine in third speed, as otherwise the oil will not be taken up by the gum solution. When all the oil has been added, stop the machine, scrape the walls of the kettle with a long-bladed spatula and add 5 oz. of benzoate of soda in solution to prevent fermentation. Start the machine again in third speed for about 5–10 minutes.

Formula No. 2[12]

Gum Arabic	13 oz.
Terpeneless Oil of Lemon	20 oz.

Lemon Oil	20 oz.
Glycerin	40 oz.
Water	To make 10 gal.

Mix the gum arabic and glycerin, then mix in the terpeneless oil of lemon and the lemon oil; add water slowly with good stirring. Beat intermittently until homogeneous. Pass through an homogenizer.

Transparent Lemon Oil Emulsion[13]

Invert Sugar Syrup (80%)	60 lb.
Medium Fine Granulated Sugar	24 lb.
Water	16 lb.
Gelatin (180 Bloom-Min.)	4 oz.

In the preparation of the emulsion, 20 oz. of terpeneless oil of lemon and 20 oz. of regular lemon oil are mixed with enough of the above solution to produce 10 gal. This mixture is then homogenized and left standing for 18 hours which allows entrapped air bubbles to rise to the surface. Glass containers are filled from the bottom outlet of the emulsion container and tightly stoppered. The resultant emulsion will be practically transparent.

Orange Oil Emulsion[14]

Gelatin	4 oz.
Water	16 lb.
Cane Sugar	24 lb.
Invert Sugar	60 lb.
Terpeneless Orange Oil	20 oz.
Orange Oil	20 oz.

Dissolve the gelatin in the water, add the cane sugar and heat until dissolved. Add the invert sugar and mix well; homogenize.

Orange Emulsion (Cloudy)[15]

Gum Arabic (Best Grade)	1 lb.
Water	1 pt.
Orange Oil	6 dr.

Let the gum arabic and water stand overnight; mix and filter. Add the orange oil. Mix and pass through a colloid mill. Use ½ oz. per gallon of syrup.

Bitter Almond Oil Emulsion[16]

Gum Arabic	10
Bitter Almond Oil	2
Cane Sugar	8
Water	120

Mix the sugar and gum; add to the water, which is agitated by means of a rapid mixer. Then allow to mix until a uniform emulsion results. Add the oil slowly until completely emulsified.

Butter Substitute

Formula No. 1[17]

Glycerol Monostearate	85 lb.
Coconut Oil (76°F. Titer)	800 lb.
Cottonseed Oil, Winterized	125 lb.
Cultured Milk	50–55 gal.

Melt and mix the glyceryl monostearate, coconut oil and cottonseed oil; churn with the milk, temper, work and salt.

Formula No. 2[18]

Soya Bean Lecithin (60–65%)	100
Glyceryl Distearate	100

Melt together and mix in

Water, Hot	100

Add and mix in

Water, Warm	500

One part of this mixture is added to 100 parts plastic margarine.

Formula No. 3[19]

Water	120
Galagum C	1

Cottonseed Oil	40
Caustic Soda	0.02
Butter Flavor	To suit

Dissolve the caustic soda in the water and strew the galagum C on the surface; bring to a boil while stirring; run the cottonseed oil and butter flavor into it slowly, with high-speed intermittent stirring.

Mayonnaise

Formula No. 1[20]

Frozen Egg Yolk	120
Winter Oil (Cottonseed)	330
Spice Mixture *	24
Vinegar **	160
Spice Mixture *	
Salt	200
Mustard (Ground) No. 1	100

Mix the frozen egg yolk, which must be taken out of the refrigerator the night before making the batch, with a part of the vinegar and the spices. Be sure to keep some vinegar back to be added last or if the batch breaks. Allow the oil to flow in slowly.

Formula No. 2[21]

Frozen Egg Yolk	7½
Winter Oil (Cottonseed Oil)	33
Spice Mixture (As in Formula No. 1)	2
Vinegar (As in Formula No. 1)	10

Formula No. 3[22]

Cottonseed Salad Oil	70.25
Egg Yolk	10.00
Vinegar (50 Grain)	10.00
Water	3.90
Salt	1.45

---

* Refer to government definitions and standards for food products.

** Use cider vinegar. Dilute 9 gal. of vinegar with 1 gal. of water.

Sugar	3.50
Mustard	0.80
White Pepper	0.10

The quantity of egg yolk may be reduced to 7.5 lb. The sugar may be left out.

Formula No. 4 [23]

Frozen Egg Yolk	4½	lb.
Winter-Pressed Cottonseed Oil	75	lb.
Salt	13	oz.
Mustard No. 2	8	oz.
White Vinegar	1	qt.
Water	2	qt.

Formula No. 5 [24]

Egg Yolk (Fresh)	12	lb.
Sugar	2½	lb.
Mustard Flour	1	lb.
Salt	1 lb. 7	oz.
Onion Juice (Fresh)	2	oz.
Paprika	¾	oz.
Pepper (White)	¾	oz.
Oil (Salad)	13	gal.
Vinegar (100 Grain, White)	4	qt.
Water	2	qt.

Put the yolks into the beater bowl. Set the beater at high speed. Beat the yolks until they are well broken up, about a minute.

Add the sugar, mustard flour, salt, paprika and pepper, and beat until creamed. This will require from 2 to 5 minutes, depending on the amount of egg white that adheres to the yolks. The more whites present, the longer will be the time required.

Add the oil slowly at first, and then add at the rate of 1 gal. per minute, until 9 gal. have been added.

Run the beater on slow speed while 1 qt. of vinegar and 1 qt. of water are added and thoroughly mixed in. Then run beater on high speed and slowly add remainder of oil at the rate of 1 gal. every 2 minutes. Shift beater to slow speed, and add the remainder of the vinegar and water.

Shut off beater. Scrape down sides of bowl. At slow speed, mix entire batch for 2 minutes longer. Long beating of the entire mix tends to make the mayonnaise thinner.

Formula No. 6[25]
(Modified)

Salad Oil	20	lb.
Egg Yolk	2	lb.
100-Grade Pectin (Citrus)	1½	oz.
Sugar	4¾	oz.
Salt	4¾	oz.
Mustard	2½	oz.
Concentrated Lemon Juice	3	oz.
Water	14	oz.
Vinegar	20	oz.

Formula No. 7[26]

Egg Yolk	14	lb.
Vinegar	10	lb.
Cottonseed Oil (Prime Summer Yellow)	70	lb.
Salt	1½	lb.
Sugar	3½	lb.
Mustard	¾	lb.
Pepper	¼	lb.

Mix thoroughly in mixing bowls and run through a colloid mill with a clearance of 0.005 inch.

Salad Dressings

Formula No. 1[27]

Cornstarch	5
Water	90
Cottonseed Oil	51
French Mustard	25
Salt	5
Sugar	10
Vinegar (White)	42

Mix the cornstarch with a little cold water and add to the remaining hot water. Stir and boil until it stiffens, set aside to cool. Put the mustard into a bowl and gradually add the oil, stirring all the time. Next add sugar, salt, vinegar and then the cooled-down cornstarch.

Formula No. 2 [28]

Tapioca Starch	7
Water	30
Corn Oil or Cottonseed Oil	40
Salt	2
Cane Sugar	4
Vinegar (White 5%)	17

Formula No. 3 [29]

Whole Eggs	9	
Mazola (Corn Oil)	12	pt.
No. 2 Buffalo Starch	2.4	lb.
Water	2	gal.
Vinegar	7	pt.
Cerelose (Corn Sugar)	2.4	lb.
Salt	9.6	oz.
Mustard	9.6	oz.
Paprika	0.96	oz.

Formula No. 4 [30]

Whole Eggs	11	
Mazola	16	pt.
No. 2 Buffalo Starch	1.8	lb.
Water	11	pt.
Vinegar	7	pt.
Cerelose	2.4	lb.
Salt	9.6	oz.
Mustard	9.6	oz.
Red Pepper	0.96	oz.

REFERENCES

[1] Fiene and Blumenthal, Handbook of Food Mfg. (1938).
[2] Green, U. S. 2,097,225 (1937).
[3] Bennett, Chem. Formulary, Vol. 1, p. 54 (1933).

[4] Bennett, Chem. Formulary, Vol. 4, p. 131 (1939).
[5] Bennett, Chem. Formulary, Vol. 1, p. 57 (1933).
[6] Bennett, Chem. Formulary, Vol. 5, p. 145 (1941).
[7] Bennett, Chem. Formulary, Vol. 5, p. 145 (1941).
[8] Bennett, Chem. Formulary, Vol. 3, p. 150 (1936).
[9] Bennett, Chem. Formulary, Vol. 5, p. 146 (1941).
[10] Bennett, Chem. Formulary, Vol. 3, p. 151 (1936).
[11] Fiene and Blumenthal, Handbook of Food Mfg. (1938).
[12] Fiene and Blumenthal, Handbook of Food Mfg. (1938).
[13] Bennett, Chem. Formulary, Vol. 5, p. 119 (1941).
[14] Handbook of Food Mfg., Fiene and Blumenthal.
[15] Bennett, Chem. Formulary, Vol. 4, p. 45 (1939).
[16] Personal Communication.
[17] Bennett, Chem. Formulary, Vol. 5, p. 146 (1941).
[18] Bennett, Chem. Formulary, Vol. 5, p. 146 (1941).
[19] Bennett, Chem. Formulary, Vol. 1, p. 47 (1933).
[20] Fiene and Blumenthal, Handbook of Food Mfg. (1938).
[21] Fiene and Blumenthal, Handbook of Food Mfg. (1938).
[22] Fiene and Blumenthal, Handbook of Food Mfg. (1938).
[23] Fiene and Blumenthal, Handbook of Food Mfg. (1938).
[24] Bennett, Chem. Formulary, Vol. 5, p. 147 (1941).
[25] Bennett, Chem. Formulary, Vol. 5, p. 147 (1941).
[26] Bennett, Chem. Formulary, Vol. 4, p. 133 (1939).
[27] Handbook of Food Mfg., Fiene and Blumenthal.
[28] Handbook of Food Mfg., Fiene and Blumenthal.
[29] Crowley, Money Making Formulas.
[30] Crowley, Money Making Formulas.

CHAPTER XXI

GASOLINE EMULSIONS

Formula No. 1[1]

Triethanolamine	1½
Water	1
Oleic Acid	1½
Butanol	5
Gasoline	45

DISSOLVE triethanolamine in water and add the mixture of other ingredients slowly while stirring vigorously.*

Formula No. 2[2]

Triethanolamine	1
Water	1
Oleic Acid	1
Butanol	5
Gasoline	45

Formula No. 3[3]

Triethanolamine	½
Water	1
Oleic Acid	½
Butanol	5
Gasoline	45

Formula No. 4[4]

Triethanolamine	½
Oleic Acid	1
Water	1
Butanol	5
Gasoline	45

---

* The stability of these emulsions is improved considerably if they are passed through a colloid mill.

Formula No. 5 [5]

Triethanolamine	1
Water	1
Oleic Acid	1
Butanol	2
Alcohol	4

Formula No. 6 [6]

Triethanolamine	1
Water	1
Oleic Acid	1
Butanol	4
Alcohol	2

Formula No. 7 [7]

Triethanolamine	1
Water	1
Oleic Acid	1
Butanol	5
Kerosene	20
Gasoline	25

Formula No. 8 [8]

Triethanolamine	1
Water	1
Oleic Acid	1
Alcohol	3
Gasoline	45

Formula No. 9 [9]

Triethanolamine	1
Water	1
Stearic Acid	5
Alcohol	3
Gasoline	45

Formula No. 10 [10]

Triethanolamine	1
Water	1

Stearic Acid	3
Alcohol	3
Gasoline	45

Formula No. 11[11]

Triethanolamine	1
Water	1
Stearic Acid	2
Alcohol	3
Gasoline	45

Formula No. 12[12]

Triethanolamine	1
Water	1
Stearic Acid	3
Alcohol	2
Gasoline	45

Formula No. 13[13]

Triethanolamine	½
Water	1
Stearic Acid	3
Alcohol	3
Gasoline	45

Formula No. 14[14]

Triethanolamine	¼
Water	½
Stearic Acid	3
Alcohol	3
Gasoline	45

Formula No. 15[15]

Triethanolamine	¼
Water	½
Stearic Acid	2
Alcohol	2
Gasoline	45

Formula No. 16[16]
(0.25% Water)

Triethanolamine	175
Water	85
Stearic Acid	1400
Alcohol	1400
Gasoline	31500

Formula No. 17[17]
(0.5% Water)

Triethanolamine	175
Water	175
Stearic Acid	1400
Alcohol	1400
Gasoline	31500

Formula No. 18[18]
(0.75% Water)

Triethanolamine	175
Water	260
Stearic Acid	1400
Alcohol	1400
Gasoline	31500

Formula No. 19[19]
(1% Water)

Triethanolamine	175
Water	350
Stearic Acid	1400
Alcohol	1400
Gasoline	31500

Formula No. 20[20]
(1% Water)

Trihydroxyethylamine Linoleate	2100
Gasoline	31500
Butanol	3500
Water	700
Triethanolamine	1050

Formula No. 21[21]
(5% Water)

Trihydroxyethylamine Laurate	2100
Gasoline	31500
Butanol	3500
Water	1750
Triethanolamine	1050

Formula No. 22[22]
(10% Water)

Trihydroxyethylamine Laurate	3500
Gasoline	31500
Butanol	5600
Water	3500
Triethanolamine	1750

Formula No. 23[23]

Gasoline	70.0
Alcohol	9.0
Water	20.3
Bentonite	0.7

Formula No. 24[24]

Gasoline	80.0
Water	19.3
Bentonite	0.7

Anti-knock Fuel[25]

Triethanolamine	18
Oleic Acid	58
Butyl Cellusolve	20
Secondary Hexyl Alcohol	25
Water	75
Gasoline	750

Solidified Gasoline

Formula No. 1[26]

Coconut Oil	50 g.
Caustic Soda Solution (10%)	46 cc.

Water	120 cc.
Benzol	60 cc.
Gasoline	5 gal.

Mix the coconut oil, caustic soda solution, alcohol, and 20 cc. of the water, and heat until completely saponified. Then add the remaining 100 cc. of the water. Add to this the benzol and stir until completely emulsified. Then add the gasoline in small portions, while stirring vigorously with a mechanical stirrer. The resulting jelly-like mass forms a very stable emulsion.

Formula No. 2[27]

Stearic Acid	35
Caustic Soda (30%)	7
Alcohol	500
Gasoline	4500

Formula No. 3[28]

Gasoline	0.5 gal.
White Soap (Finely Shaved)	12.0 oz.
Water	1.0 pt.
Household Ammonia	5.0 oz.

Heat the water, add soap, mix; when it is cool add the ammonia. Then work in slowly the gasoline to form semi-solid mass.

Sound-absorbing Composition

Exfoliated mica is used with the following binder:

Casein	25
Water	32
Caustic Soda (15%)	10
Alum	2½

After the casein has swelled and mixed until smooth, run in slowly with good mixing

Water	57½
Gasoline	57½

Put into forms and allow to dry.

REFERENCES

[1] Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[2] Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[3] Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[4] Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[5] Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[6] Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[7] Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[8] Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[9] Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[10] Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[11] Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[12] Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[13] Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[14] Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[15] Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[16] Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[17] Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[18] Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[19] Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[20] Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[21] Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[22] Bennett, Chem. Formulary, Vol. 3, p. 107 (1936).
[23] Personal Communication.
[24] Personal Communication.
[25] Bennett, Chem. Formulary, Vol. 5, p. 603 (1941).
[26] Bennett, Chem. Formulary, Vol. 2, p. 237 (1935).
[27] Klinkenstein, U. S. 1,848,568 (1932).
[28] Bennett, Chem. Formulary, Vol. 4, p. 15 (1939).

CHAPTER XXII

LACQUER EMULSIONS

Nitrocellulose Emulsions

PART A

Lacquer Base Formulae (Clear)

	Formula No. 1	No. 2	No. 3	No. 4	No. 5
Nitrocellulose (Dry Weight)	30	25	30	30	40.0
Castor Oil	30	..	..	..	...
Triethyl Citrate	..	20	..	..	5.0
Tricresyl Phosphate	..	..	12	..	...
Dibutyl Phthalate	..	..	..	13	...
Resin (Alkyd)	..	10	15	15	...
Butyl Acetate	25	25	25	22	30.0
Xylene	..	5	..	..	7.5
Butanol	15	15	18	20	17.5

Formula No. 6

Pigmented Nitrocellulose (Dry Weight)	20
Resin (Alkyd)	8
Castor Oil (Blown)	6
Diamyl Phthalate	6
Carbon Black	2
Xylene	14.4
Octyl Acetate	10
Butyl Acetate	25
Alcohol (Present in Nitrocellulose)	8.6

Any of these formulae can be emulsified without much difficulty using any of the emulsifiers of Part B. The choice depends on the properties which are desired on the dried film.

Lacquer Emulsifiers

PART B

Formula No. I

Duponol	0.5
Sulfonated Castor Oil	1.0
Water	98.5

Formula No. II

Duponol	0.5
Sulfonated Castor Oil	1.0
Acetone	10.0
Water	88.5

Formula No. III

Duponol	0.5
Sulfonated Castor Oil	1.0
Casein	0.5
Water	98.0

Formula No. IV

Duponol	0.5
Sulfonated Castor Oil	1.0
Gelatin	2.0
Water	96.5

Formula No. V

Duponol	0.5
Sulfonated Castor Oil	1.0
Casein	0.5
Acetone	10.0
Water	88.0

Formula No. VI

Sodium Oleate	6
Water	94

Formula No. VII

Duponol	0.5
Sulfonated Castor Oil	1.0
Methyl Cellulose	0.3
Water	98.2

The emulsion stability varies with the composition of the lacquer phase. The presence of resins in lacquer usually aids the dispersion, both as to the ease of forming the emulsion and the uniformity of droplet size.

The presence of acetone gives increased emulsifying power for nitrocellulose rich lacquers and depresses the freezing temperature of the emulsion. When acetone is replaced by a water-miscible high-boiling solvent the tendency of film-blush is decreased.

Formulae 3, 4, 5, 8 are all of the same general type, i.e., they contain an auxiliary emulsifier or stabilizer. This additional material helps produce emulsions from lacquers of very high viscosity and those that are relatively rich in nitrocellulose.

While the stability of the emulsion using these emulsifying mixtures may be satisfactory, too high a concentration of the emulsifiers results in a decrease of gloss upon the surface of the dried films.

If the concentration is decreased to get an O/W emulsion, a poor emulsion results (only partially emulsified).

Lacquer emulsions with casein are O/W emulsions; with gelatin they are W/O emulsions. Methyl cellulose is an exceptionally good emulsifying aid.[1] The upper limit of methyl cellulose that can be included without producing "flatting" of the film is 0.03%.

Formula No. 7 [2]

Lacquer Phase

Nitrocellulose (15–20 Seconds Viscosity, Dehydrated Butanol)	19.3
Butanol	4.0
Petrex #5	8.0
Dibutylphthalate	10.8

Titanox A	13.5
Butyl Acetate	12.3
Pent Acetate	12.3
Toluol	19.8

Water Phase

Water	86.5
Acetone	10.0
Duponol ME	0.5
Sulfonated Castor Oil	1.0
Casein	1.0
Borax (5% Solution)	1.0

Formula No. 8[3]

Lacquer Phase

Nitrocellulose (5–6 Seconds Viscosity, Dehydrated Butanol)	28.6
Dibutylphthalate	8.0
Castor Oil AA	2.0
Carbon Black	2.0
Octyl Acetate	11.5
Secondary Hexyl Acetate	11.5
Hexone	11.5
Xylol	24.9

Water Phase

Duponol ME (Dry)	0.5
Sulfonated Castor Oil	1.0
Methyl Cellulose	0.3
Acetone	10.0
Water	88.2

Formula No. 9[4]

Lacquer Phase

Nitrocellulose (15–20 Seconds Viscosity, Dehydrated Butanol)	21.4
Titanium Dioxide	4.0
Chrome Yellow	4.0
Dibutylphthalate	8.0
Petrex #5	10.0

Secondary Hexyl Acetate	16.4
Pent Acetate	3.6
Hexone	7.3
Xylol	11.8
Toluol	11.0
Butanol	2.5

Water Phase

Duponol ME	0.5
Sulfonated Castor Oil	1.0
Casein	1.0
Borax (5% Solution)	1.0
Acetone	10.0
Water	86.5

Formula No. 10[5]

Lacquer Phase

RS ½" N.C. (Dry Wt.)	24.0
Glyptal 2471 (Solid)	12.0
Tricresyl Phosphate	14.0
Butanol Carried by N.C.	10.3
Toluol	14.7
Butyl Acetate	12.5
Hexone	12.5

Water Phase

Duponol ME	0.5
Sulfonated Castor Oil	1.0
Acetone	10.0
Water	88.5

Formula No. 11[6]

The solids content of the lacquer base can be increased to 60% in special formulations by using low-viscosity type nitrocellulose, a solvent plasticizer, and an exceptionally good solvent mixture. This allows a 1:1 ratio of solvent to water. The formulation below is a typical example of such a composition.

Lacquer Phase

RS ½″ N.C. (Dry Wt.)	30.0
Glyptal 2471 (Solid)	13.0
Dibutyl Phthalate	17.0
Butanol Carried by N.C.	12.9
Toluol	13.0
Secondary Hexyl Acetate	7.0
Hexone	7.1

Water Phase

Duponol ME (Dry)	0.5
Sulfonated Castor Oil	1.0
Acetone	10.0
Water	88.5

Formula No. 12[8]

Lacquer Phase

RS 5–6″ N.C. (Dry Wt.)	21
Glyptal 2471 (Solid)	8
Tricresyl Phosphate	12
Butanol Carried by N.C.	9
Toluol	12
Xylol	12
Hexyl Acetate	12
Hexone	12

Water Phase

Duponol ME (Dry)	0.5
Sulfonated Castor Oil	1
Acetone	10
Water	88

Formula No. 13[9]

Lacquer Phase

RS 15–20″ N.C. (Dry Wt.)	18.0
Ester Gum	9.0
Dibutyl Phthalate	8.0
Butanol Carried by N.C.	7.8
Toluol	27.2

Butyl Acetate	15.0
Hexone	15.0

Water Phase

Duponol ME (Dry)	0.5
Sulfonated Castor Oil	1.0
Acetone	10.0
Water	88.5

Black-pigmented Lacquer Emulsion[9]

Lacquer Phase

RS ½ Sec. (Dry Wt.)	20.0
Dammar Gum (Dewaxed) (Dry Wt.)	6.0
Dibutyl Phthalate	3.0
Tricresyl Phosphate	2.6

Water Phase

Water	98.50
Duponol ME (Dry)	0.25
Sulfonated Castor Oil	1.25

Lacquer Phase

Blown Castor Oil	5.4
Carbon Black	2.0
Butanol Carried by Nitrocellulose	8.6
Butanol	5.0
Denatured Ethyl Alcohol (in Dammar Solution)	4.0
Hi-Flash Solvent Naphtha	13.8
Toluol (in Dammar Solution)	2.0
Secondary Hexyl Acetate	13.8
Octyl Acetate	13.8

The ratio of lacquer phase to water phase recommended is: from 2.5 to 1, to 3 to 1 parts by weight.

Gray-pigmented Lacquer Emulsion[10]

Lacquer Phase

RS ½ Sec. (Dry Wt.)	18.0
Dammar Gum (Dewaxed) (Dry Wt.)	5.4
Tricresyl Phosphate	3.0
Blown Castor Oil	6.0
Gray Pigment *	12.0
Butanol Carried by Nitrocellulose	7.8
Butanol	1.9
Denatured Ethyl Alcohol (in Dammar Solution)	4.0
Hi-Flash Solvent Naphtha	14.0
Toluol (in Dammar Solution)	2.0
Secondary Hexyl Acetate	13.0
Octyl Acetate	12.9

Water Phase

Water	98.20
Duponol ME (Dry)	0.25
Sulfonated Castor Oil	1.25
Methyl Cellulose	0.30

The ratio of lacquer phase to water phase recommended is: from 2 to 1, to 2.5 to 1 parts by weight.

REFERENCES

[1] Personal Communication.
[2] Hercules Powder Co., Wilmington, Del.
[3] Hercules Powder Co., Wilmington, Del.
[4] Hercules Powder Co., Wilmington, Del.
[5] Hercules Powder Co., Wilmington, Del.
[6] Hercules Powder Co., Wilmington, Del.
[7] Hercules Powder Co., Wilmington, Del.
[8] Hercules Powder Co., Wilmington, Del.
[9] Bennett, Chem. Formulary, Vol. 4, p. 97 (1939).
[10] Bennett, Chem. Formulary, Vol. 4, p. 97-98 (1939).

---

* Composition of Gray Pigment

Zinc Oxide	96.0	Prussian Blue	0.7
Chrome Yellow	1.6	Iron Oxide	1.0
Carbon Black	0.7		

CHAPTER XXIII

LEATHER TREATMENT EMULSIONS

Fat-liquors

Formula No. 1[1]

Paraffin Oil	60 lb.
Sulfonated Cod Oil	40 lb.
Borax	2 lb.
Water (at 140° F.)	20 gal.

Formula No. 2[2]

Fig Soap	20 lb.
Water	30 gal.
Waterless Moellon	30 gal.
Sulfonated Cod Oil	20 lb.
Paraffin Oil	30 lb.
Water	To make 50 gal.

Formula No. 3[3]

Soap	1½
Neatsfoot Oil	1½
Soda	¼
Water	97

Formula No. 4[4]

Sulfonated Cod Oil	2
* Stock Solution	2

---

* Stock Solution

Cod Oil	50
Degras	50
Soap	6
Bicarbonate of Soda	3
Water	5500

Formula No. 5

Sulfonated Neatsfoot Oil	20–40
Spindle Oil	10–20
Neatsfoot Oil	100–80

	Formula No. 6 [5]	No. 7 [5]	No. 8 [5]
Sulfonated Neatsfoot Oil	30	20	25 lb.
Neatsfoot Oil	40	40	30 lb.
Mineral Oil	20	20	20 lb.
Soap	10	20	25 lb.

Five per cent emulsions of the above formulas are used at pH of 6.5–8.0.

Formula No. 9 [6]

Water (150°F.)	1 gal.
Sulfonated Cod Oil	2 lb.
Raw Cod Oil	1 lb.
Light Mineral Oil	2 lb.
Tallow Soap, Dissolved in 1 Gal. Water	1 lb.

Formula No. 10 [7]

Cold-Test (20°) Neatsfoot Oil	50 gal.
Paraffin Oil (28°)	25 gal.
Water	25 gal.
Sulfonated Castor Oil (50%)	25 lb.

Mix water first with the sulfonated castor oil. Then mix all ingredients at 30°C.

Leather Dressings

Formula No. 1 [9]

Tallow	70.0
Petroleum Jelly	3.5
Diglycol Stearate	13.0
Beeswax	9.0
Rosin	2.0
Water	2.0

Leather Finishes and Polishes

Formula No. 1[10]

Beeswax	5
Gray Fatty Carnauba Wax	1
Olive Oil Bar Soap	5
Ammonia	1
Water	100
Glycerin	1

The soap is dissolved in about 50 parts of hot water and the ammonia added. The wax mixture is melted separately and added with stirring to the soap solution. The temperature of the soap solution must be well above the setting point of the wax, preferably about 90°C. When the emulsion is satisfactorily made, the remainder of the water and the glycerin can be added and the mixture cooled down. A mixture of beeswax and carnauba is used here because the beeswax alone is too soft and sticky, whereas the carnauba alone would present difficulties in emulsification. Such a mixture is suitable for application to shoe calf and gives a soft brush-polished finish.

Formula No. 2[11]

Castile Soap	15 lb.
Carnauba Wax (No. 1 Yellow)	5 lb.
Candelilla Wax	5 lb.
Water	To make 10 gal.

Dissolve the soap in 8 gal. of water by boiling for 1 hour, adding water as it is lost by evaporation; add melted wax and continue boiling for 2 more hours, then add water enough to make a total of 10 gal. Strain the mass through 4 layers of cheese cloth.

Formula No. 3[12]

Gray Fatty Carnauba Wax	20 lb.
Turpentine	10 lb.
Olive Oil Soap	10 lb.

Water	16 gal.
Turkey Red Oil (50%)	20 gal.

The carnauba wax and turpentine are melted in a steam-jacketed mixing pan. The soap, previously dissolved in the hot water, is added with constant stirring and the mixture boiled for 10 minutes, when the steam can be turned off and the Turkey red oil added. The hot liquid is run through a water-cooled colloid mill which cools and emulsifies it at the same time. Glue may be used as a stabilizing colloid for the soap-wax emulsion.

Formula No. 4[13]

Gray Fatty Carnauba Wax	20 lb.
Turpentine	10 lb.
Olive Oil Soap	10 lb.
Water	16 gal.
Rabbit Skin Glue	40 lb.
Water	16 gal.

Formula No. 5[14]
(Shoemakers' Wax Burnishing Polish)

Carnauba Wax	10
Turpentine	10
Duponol WA Paste	10
Iron Chloride or Acetate	3
Acetic Acid (10%)	2
Water	65

Melt the wax and turpentine together and pour into a solution of the Duponol in 45 parts of the water at 95–100°C. Stir vigorously until a smooth emulsion is formed and then stir gently until the emulsion has cooled to approximately 35°C. At this point add a solution containing the iron salt and acetic acid, dissolved in the remaining 20 parts of water. Continue stirring slowly. The viscosity of the emulsion will be greatly increased at first, after which it will return to its initial value; the resulting emulsion is a smooth, fluid paste.

Formula No. 6[15]

Shellac Wax	3
Montan Wax	3
Carnauba Wax	3
Paraffin Wax	2
Japan Wax	1
Varnish, Acetone	1
Lacquer, Nitrocellulose	1
Lacquer, Acetate	1
Carbon Tetrachloride	20
Water	20
Soda	3
Castor Oil	1
Naphtha	5
Turpentine Substitute	40
Bornyl Acetate	1
Shellac	1

Edge-filler for Shoe Factory Use[16]

Soap	15	lb.
Yellow Dextrin	5½	lb.
Neatsfoot Oil	1½	qt.
Oil of Mirbane	1	pt.
Gelatin	11½	lb.
Formaldehyde	1	qt.
Water	1	qt.

This is made up with sufficient water to make 60 gal. of solution.

Softener for Leather Goods[17]

Glue	3
Montan Wax	5
Synthetic Wax (Glyceryl Monostearate)	10
Sulfonated Neatsfoot Oil	40
Glycerin	0.5
Water	41.5

Soften glue in water, heat waxes just slightly above melting point, keep at same temperature while stirring in part of water; add sulfonated oil and keep stirring; add rest of water containing glue and softener.

References

[1] Bennett, Chem. Formulary, Vol. 2, p. 288 (1935).
[2] Bennett, Chem. Formulary, Vol. 2, p. 289 (1935).
[3] Bennett, Chem. Formulary, Vol. 4, p. 159 (1939).
[4] Bennett, Chem. Formulary, Vol. 4, p. 159 (1939).
[5] Bennett, Chem. Formulary, Vol. 4, p. 190 (1939).
[6] Bennett, Chem. Formulary, Vol. 4, p. 157 (1939).
[7] Bennett, Chem. Formulary, Vol. 3, p. 200 (1936).
[9] Bennett, Chem. Formulary, Vol. 1, p. 424 (1933).
[10] Davidsohn and Davidsohn, Shoe Finishes and Polishing Waxes.
[11] Bennett, Chem. Formulary, Vol. 4, p. 178 (1939).
[12] Davidsohn and Davidsohn, Shoe Finishes and Polishing Waxes.
[13] Davidsohn and Davidsohn, Shoe Finishes and Polishing Waxes.
[14] E. I. du Pont de Nemours Co., Wilmington, Del.
[15] Veith, Brit. 425,323 (1935).
[16] Bennett, Chem. Formulary, Vol. 3, p. 205 (1936).
[17] Bennett, Chem. Formulary, Vol. 7, p. 219 (1945).

CHAPTER XXIV

LUBRICANT EMULSIONS

Lubricant Grease

Formula No. 1[1]

White

a.	Stearic Acid	10
	Paraffin Oil, White	30
b.	Lime Hydrate	
	Water	2
c.	Paraffin Oil, White	56

Melt *a,* saponify hot with *b;* add *c* in small portions. Keep stirring until cold.

Formula No. 2[1]

Yellow

a.	Train Oil Fatty Acid	16
	Mineral Oil, Pale	30
b.	Lime Hydrate	
	Water	2
c.	Mineral Oil, Pale	48

Prepare as in formula No. 1.

Formula No. 3[2]

Green Petrolatum	250 lb.
Paraffin Pale Oil (28° Bé.)	92 gal.
Lime	9 lb.
Fat	55 lb.
Water	3 gal.

Formula No. 4[3]

Train Oil Fatty Acid	12
Lime, Hydrated	2
Zinc Oxide	2
Spindle Oil	82
Water	2

"Cold Roller Grease Briquets"

Formula No. 1[4]

Crude Woolfat	15
Stearin	5
Cylinder Oil (7 E. at 100°C.)	78
Caustic Soda (40° Bé.)	6

Formula No. 2[5]

Tallow	20
Caustic Soda (40° Bé.)	8.5
Cylinder Oil (7 E. at 100°C.)	77

Horse-shoe Grease[6]

Woolfat, Neutral	5.2
Spindle Oil	2.0
Soft Tar	0.5
Paraffin Wax	0.3
Water	About 2.4

Mixed-base Grease[7]

Lime	17 lb.
Fat	113 lb.
Pale Oil (100 Visc.)	112 gal.
Aluminum Oleate (Pulp Stock)	50 lb.
Water	6 gal.

Place the fat in a steam-jacketed kettle equipped with paddles for stirring; add a small portion of the mineral oil; mix the lime with sufficient water to form a thin paste and add this to the material in the kettle. Turn on the steam and start the paddles. When the soap has cooked for 5 hours it should be tested to determine if saponification is completed; if so, the steam is turned off and half of the balance of the mineral oil is run in slowly. The rest of the mineral oil is run into a separate kettle and the aluminum oleate melted in it; this mixture is pumped into the first kettle while still warm. Stirring should be continued until a smooth uniform grease is produced.

Soap-base Lubricating Emulsions[8]

a. Cottonseed Oil	3 kg.
Mineral Oil	1–2 kg.
Caustic Soda	132 g.
b. Mineral Oil	13 kg.
c. Water	9 kg.

Heat *a* to 180°C. until foaming stops. Add *b* in successive portions with stirring, bringing up to 190–210°C. Pour into wooden tubs and cool to 70°C. Add *c* with stirring.

Viscous Emulsion Lubricant[9]

Heavy Mineral Oil	10
Diglycol Stearate	10
Water	40

Heat together to 60°C. and stir until cold. A heavy cream results. The color is dependent on the color of the oil used.

Water-in-oil Emulsion Lubricant[10]

Fifty g. of a heavy paraffin oil is mixed with 1 g. of n-lauryl-l-sulphuric acid and stirred with 0.25 g. of lead acetate dissolved in 48.75 g. of water. The resulting emulsion is a heavy grease and has good lubricating properties. It may readily be extended with oil.

Graphite Lubricant[11]

Degras (Free from Fatty Acids)	20
Kerosene	16

Water	75
Turpentine	8.7
Ammonia (28%)	4.4
Graphite Powder	30

Anti-corrosive Spindle Lubricant[12]

Oleic Acid	3
Potash (26° Bé.)	7
Alcohol	2
Mineral Oil	88

REFERENCES

[1] Bennett, Chem. Formulary, Vol. 4, p. 192 (1939).
[2] Personal Communication.
[3] Bennett, Chem. Formulary, Vol. 3, p. 213 (1936).
[4] Bennett, Chem. Formulary, Vol. 4, p. 195 (1939).
[5] Bennett, Chem. Formulary, Vol. 4, p. 195 (1939).
[6] Bennett, Chem. Formulary, Vol. 4, p. 203 (1939).
[7] Bennett, Chem. Formulary, Vol. 3, p. 209 (1936).
[8] Bennett, Chem. Formulary, Vol. 3, p. 111 (1936).
[9] Bennett, Chem. Formulary, Vol. 2, p. 302 (1935).
[10] Bennett, Chem. Formulary, Vol. 4, p. 210 (1939).
[11] Bennett, Chem. Formulary, Vol. 3, p. 213 (1936).
[12] Bennett, Chem. Formulary, Vol. 7, p. 230 (1945).

CHAPTER XXV

MEDICINAL EMULSIONS

Burn Ointments

Formula No. 1[1]

Lanolin	30
Olive Oil	25
Spermaceti	10
Cycloform	10
Water	25

Formula No. 2[2]

Glyceryl Monomyristate	10.0
Butyl Myristate	10.0
Olive Oil	7.5
Alcohol	10.0
Cycloform	10.0
Betanaphthol	2.5
Water	50.0

Cod Liver Oil Emulsions

Formula No. 1[3]

Cod Liver Oil	26	oz.
Water	44	oz.
Tragacanth	50	g.
Glycerin	5	oz.
Calcium Hypophosphite	½	oz.
Sodium Hypophosphite	½	oz.
Saccharin	0.001	oz.

* Formula No. 2 [4]

a.	Cod Liver Oil	420
	Gum Arabic	15
	Gum Tragacanth	7½
b.	Gelatin	1
	Water	299
c.	Calcium Hypophosphite	12
	Sugar	90
	Water	60
	Water	86

Make up *a* by grinding, and *b* by heating. Add *b* to *a* at once and stir until cooled.

To the cooled emulsion add the cooled solution *c* slowly, with good agitation.

* Formula No. 3 [5]

a.	Gum Arabic	100
	Gum Tragacanth	100–120
	Glycerin	1200
b.	Cod Liver Oil, Crude	3700
c.	Calcium Hypophosphite	50
	Sodium Hypophosphite	50
	Water	4000

Grind *a* until smooth, add *b* in small portions, homogenizing every time. To this add *c* in an emulsifying machine.

* Formula No. 4 [6]

Gum Arabic	12
Gum Tragacanth	16
Glycerin (28° Bé.)	140
Distilled Water	430
Moldex or Other Preservative	1
Cod Liver Oil	300
Spice Oil Mixture	10
Calcium Hypophosphite	8

---

* Used in veterinary practice.

Sodium Hypophosphite	12
Distilled Water	71

* Formula No. 5[7]

a. Carragheen Moss	15.0
Water	30.0
Cod Liver Oil	50.0
Preservative	0.1
b. Starch Syrup	8.8
Water	9.0
Spice Decoction	0.1

* Formula No. 6[8]

Carragheen Moss	12
Distilled Water	300
Moldex or Other Preservative	1
Cod Liver Oil	500
Syrup, White	86
Distilled Water	91
Spice Oil Mixture	10

* Formula No. 7[9]

Gum Arabic	12
Gum Tragacanth	12
Glycerin (28° Bé.)	130
Water, Distilled	340
Sodium Salicylate	5
Iodine	1
Absolute Alcohol	10
Cod Liver Oil	300
Spiced Oil Mixture	10
Calcium Hypophosphite	8
Sodium Hypophosphite	12
Distilled Water	70

Formula No. 8[10]

Cod Liver Oil	52 oz.
Water	88 oz.
Glycerin	10 oz.

*** Used in veterinary practice.**

Tragacanth	100 g.
Sassafras Oil	5 cc.
Benzaldehyde	1 cc.
Coriander Oil	1 cc.
Cardamom Oil	2 cc.
Tincture Vanilla	5 cc.

Formula No. 9[11]

Calcium Hypophosphite	80 gr.
Sodium Hypophosphite	120 gr.
Sodium Chloride	60 gr.
Gum Acacia	2 oz.
Elixir of Gluside	20 min.
Almond Oil	15 min.
Glycerin	2 fl. oz.
Cod Liver Oil	8 fl. oz.
Distilled Water	To make 16 fl. oz.

Formula No. 10[12]

Calcium Hypophosphite	32 gr.
Sodium Hypophosphite	32 gr.
Gum Acacia	1 oz.
Cod Liver Oil	4 fl. oz.
Elixir of Gluside	40 min.
Cassia Oil	2 min.
Distilled Water	To make 8 fl. oz.

Formula No. 11[13]

Cod Liver Oil	4 fl. oz.
Gum Acacia	480 gr.
Cassia Oil	4 min.
Gluside	1 gr.
Distilled Water	To make 8 fl. oz.

Mix the cod liver oil and oil of cassia with the gluside and gum acacia in a dry mortar; add 2 oz. of distilled water, and triturate until an emulsion is formed. Add gradually, with constant trituration, sufficient distilled water to produce 8 oz. of mixture.

Formula No. 12[14]

Calcium Hypophosphite	160	gr.
Sodium Hypophosphite	160	gr.
Gum Acacia	2	oz.
Tragacanth	½	oz.
Cod Liver Oil	40	fl. oz.
Elixir of Gluside	4	fl. oz.
Almond Oil	6	min.
Clove Oil	6	min.
Lemon Oil	20	min.
Chloroform	15	min.
Alcohol	1	fl. oz.
Distilled Water	To make 80	fl. oz.

Formula No. 13[15]

Tragacanth	108	gr.
Alcohol	2½	fl. oz.
Almond Oil	3	min.
Cod Liver Oil	12	fl. oz.
Lemon Oil	40	min.
Syrup	1	fl. oz.
Distilled Water	12	fl. oz.

Formula No. 14[16]

Cod Liver Oil	80.0
Pectin	0.5
Milk Sugar	20.0
Water	20.0

Formula No. 15[17]

Seventy-five g. gum arabic powder is dissolved in 900 cc. water. This solution is placed in a tank fitted with mechanical stirrer, and 600 cc. cod liver oil are added. Stirring is continued for about a quarter of an hour, when a good primary emulsion is made. Further ingredients, such as oil of bitter almonds, hypophosphites, glycerophosphates, etc., are added, and the primary emulsion is fed to a De Laval homogenizer. Homogenization is carried out at a pressure of 3,500 lb. per square inch, when an absolutely stable and even emulsion is obtained of a suitable viscosity for pouring from a bottle.

Frost-bite Preventive Creams

Formula No. 1[18]

Lanolin	10.0
Cocoa Butter	15.0
Olive Oil	25.0
White Beeswax	22.0
Water	25.0
Borax	1.5
Benzoic Acid	0.5
Perfume	1.0

Formula No. 2[19]

Almond Oil	425.0
Lanolin	185.0
Beeswax	62.0
Spermaceti	62.0
Borax	4.5
Distilled Water	300.0

Mineral Oil Emulsions

Formula No. 1[20]

a.	Pharmagel-A	8	g.
	Tartaric Acid	0.6	g.
	Syrup	100	cc.
	Vanillin	0.04	g.
	Alcohol	60	cc.
	Water	To make 500	cc.
b.	Heavy Liquid Petrolatum	500	cc.

Formula No. 2[21]

a.	Gelatin, Alkali Treated (Pharmagel B)	5	g.
	Agar	2.5–5.0	g.
	Sodium Bicarbonate	5	g.
	Vanillin	0.04	g.
	Syrup	100	cc.

	Alcohol	60	cc.
	Water	To make 500	cc.
b.	Mineral Oil	500	cc.

Dissolve the gelatin and agar in 100 cc. of water with the aid of heat, cool somewhat, then add the syrup, the vanillin dissolved in the alcohol, the sodium bicarbonate and finally enough water to make the solution measure 500 cc.; add the mineral oil, mix intimately by vigorous agitation and then pass through the homogenizer several times until thoroughly emulsified. Place the emulsion in a closed container and allow to stand overnight when it will be found to be set to a soft gel due to the agar. This is now passed in the cold through the homogenizer again, which will accomplish a mechanical dispersion providing a fluid emulsion which will not again set to form a gel.

Formula No. 3 [22]

Gelatin (0.6% Porkskin, 250 Bloom)	6.0	g.
Tartaric Acid or Hydrochloric Acid	4.450	g.
Syrup	100.0	cc.
Water	To make 440.0	cc.
Vanillin	0.035	g.
Alcohol	60.0	cc.
Heavy Mineral Oil	500.0	cc.

Add the gelatin and tartaric acid to about 300 cc. of cold water, allow to stand a few minutes, then heat until dissolved. Add the syrup and finally enough water to make 440 cc. While still quite warm add the other ingredients and mix well, avoiding the inclusion of air. Finally homogenize and bottle. Homogenization should be repeated if necessary until all the oil is completely dispersed.

Such an emulsion conforms to the U. S. P. XI monograph for Emulsion of Liquid Petrolatum.

Formula No. 5 [23]

Mineral Oil	18¾	gal.
Emulsone B or Gum Tragacanth	8¾	lb.

Powdered Agar	1	lb.
Citric Acid	2	oz.

Add some sodium benzoate and Aseptoform as preservative, and a small amount of vanillin and saccharin for flavoring purposes.

Formula No. 6[24]

a.	Gelatin	27 gr.
	Water	1800 cc.
b.	Mineral Oil	2000 cc.
c.	Agar	68 gr.
	Gum Arabic	110 gr.
	Gum Tragacanth	110 gr.
	Orange Oil	3 fl. dr.
	Saccharin	10 gr.
	Tincture of Vanilla	4 fl. dr.
	Sodium Benzoate	2 dr.
	Glycerin	4 fl. dr.
	Water	2000 cc.

Make up mixture *a* and add *b* to same, using electric stirrer. Run mixture through colloid mill, using 0.010 gap setting.

Prepare mixture *c* and add to above. Run through colloid mill using 0.015 gap setting.

Add 960 gr. phenolphthalein to each gallon of emulsion.

Formula No. 7[25]

Heavy Liquid Petrolatum	500.0 cc.
Agar	5.5 g.
Sugar	120.0 g.
Acacia	30.0 g.
Tragacanth	4.0 g.
Tincture of Vanilla	8.0 g.
Tincture of Lemon	2.0 cc.
Cassia Oil	0.5 cc.
Water	To make 1000.0 cc.

Mix the agar and the sugar with 300 cc. of boiling water; when they are dissolved, strain the resulting solution and set it aside to cool. Triturate the powdered gums with the liquid petrolatum, then add the agar solution and whip the mixture with an egg beater. Add the tinctures and the oil, and lastly enough water to make 1000 cc.

Formula No. 8 [26]

Powdered Tragacanth	5.0
Moldex (Preservative)	1.0
Alcohol	10.0
Glycerin	150.0
Distilled Water	304.5
Mucilage of Gum Acacia	30.0
Liquid Paraffin (Medicinal)	500.0

If it is desired to include phenolphthalein in the emulsion, 10 parts of phenolphthalein are added in the place of an equal amount of water in the above formula.

Formula No. 9 [27]

Liquid Petrolatum		500	cc.
Acacia		125	g.
Syrup		100	cc.
Vanillin		0.035	g.
Alcohol		60	cc.
Distilled Water	To make	1000	cc.

Mix the liquid petrolatum with the powdered acacia in a dry mortar, add 250 cc. of distilled water all at once and emulsify the mixture. Then add, in divided portions and mixing after each addition, a mixture of the syrup, 50 cc. of distilled water, and the vanillin, dissolved in the alcohol. Finally add sufficient distilled water to make the product measure 1000 cc.

Liniments

Formula No. 1 [28]

Wintergreen Oil	60 cc.
Menthol	19 g.
Saponin	1 g.

Anhydrous Lanolin	65 g.
Water	210 cc.
Chloroform	10 g.

Dissolve the saponin in water. Mix wintergreen and menthol, add chloroform. Bring the two mixtures together and stir in the lanolin.

Formula No. 2[29]

Raisin Seed Oil	9
Methyl Salicylate	15
Diglycol Stearate	15
Water	61

Formula No. 3[30]

Avocado Oil	10
Methyl Salicylate	15
Diglycol Stearate	22
Water	60

Heat diglycol stearate with oil at 70°C., until dissolved. While mixing add warm methyl salicylate and then pour mixture slowly with rapid mixing into water heated to 70°C.

Formula No. 4[31]

Camphor, Powdered	4¾ lb.
Turpentine	26 lb.
Blendene	10 lb.

Mix until dissolved. Put in a pot fitted with a high-speed agitator and while mixing rapidly add the following, which had been dissolved previously:

Ammonium Chloride	7½ lb.
Stronger Ammonia Water	3¾ lb.
Water	28 gal.

Continue mixing for about 15 minutes and bottle.

Formula No. 5[32]

Ammonium Carbonate	30 g.
Water	240 cc.
Castile Soap	24 g.
Hot Water	480 cc.
Camphor	30 g.
Alcohol	30 cc.
Turpentine	Sufficient

Dissolve the ammonium carbonate in 240 cc. of water. Dissolve the soap in the hot water, then mix the two solutions. Dissolve the camphor in the alcohol and add to the first mixture; shake well. Now add the oil of turpentine in sufficient quantity to make a creamy emulsion, gradually adding and constantly shaking.

Castor Oil Emulsions

Formula No. 1[32]

Castor Oil	2 oz.
Powdered Acacia	6 dr.
Peppermint Oil	3 min.
Powdered Tragacanth	16 gr.
Saccharin	4 gr.
Glycerin	3 dr.
Cacao	2 dr.
Water	To make 4 oz.

A mixture of the cacao in the glycerin and water is made by boiling for 5 minutes. A mucilage of the acacia is made with 4 dr. of the cacao mixture and the oils are gradually incorporated by trituration until emulsified. Then the remainder of the cacao mixture is added.

Formula No. 2[34]

Sodium Hydroxide	9.8 gr.
Water	25.0 oz.
Castor Oil	6 lb. 5.0 oz.

Sodium Benzoate	100.5 gr.
Triethanolamine	288.0 min.

Dissolve the sodium hydroxide in water, add sodium benzoate and add triethanolamine.

Mix with oil and run through colloid mill. For flavor use saccharin (water-soluble) vanilla and lemon extract.

Formula No. 3 [35]

Aluminum Hydroxide Gel (3% Solids)	400
Castor Oil	700
Water	50
Flavoring and Sweetening	To suit

The water, gel and castor oil are mixed, the flavoring matter and sweetening having been previously added to the castor oil. The whole is then beaten together, forming a thick, creamy mass which is more or less stable according to the amount of mixing.

To prepare the completed product for internal administration, this cream is usually passed through a homogenizer or similar suitable emulsifying apparatus. The final product is a finely dispersed, stable white emulsion containing approximately 60% castor oil combined with approximately 1% of aluminum hydroxide on a dry basis.

Formula No. 4 [36]

Pharmagel-A		8 g.
Tartaric Acid		0.6 g.
Syrup		50 cc.
Alcohol		60 cc.
Water	To make	500 cc.
Aromatic Castor Oil N.F.		500 cc.

In making an emulsion of castor oil, the oil should be warmed to above 50°C. to render it more fluid and then mixed.

Formula No. 5 [36a]

Castor Oil	300 g.
Alcohol	100 cc.

Water	570 cc.
Sodium Benzoate	1 g.
Soybean Lecithin	50 g.

Suspend the melted lecithin in the warm alcohol mixing thoroughly. Now add the castor oil and mix again. Dissolve the sodium benzoate in the hot water, and add this solution to the first mixture. To form the emulsion rapidly agitate in a mechanical mixer for 10 to 20 minutes. Peppermint is a suitable flavor.

Water-dispersible Antiseptic Oil[37]

Diglycol Laurate	20
Coal Tar Distillate	3
Mineral Oil	77

Antiseptic Liquid[38]

Oleic Acid	7
Ti-tree Oil	3
Coconut Fatty Acid	12
Triethanolamine	10
Glycerin	2
Water	66

Mercuric Nitrate Ointment[39]

Mercuric Nitrate	11.34
Nitric Acid	1.35
Distilled Water	32.31
Beeswax U.S.P.	5.00
Cholesterol	1.50
White Petrolatum	48.50

Mix the finely powdered mercuric nitrate with 1 cc. of water, preferably in a mortar, and add the nitric acid, accurately weighed. Triturate in the mortar and add the rest of the water slowly and with constant stirring.

Melt the white petrolatum, the finely powdered cholesterol and the white wax. Continue the heat until the temperature of the mixture is raised to 80°C., and the cholesterol has completely dissolved. Stir the mixture until it congeals. By trituration, slowly incorporate the aqueous solution of mercuric nitrate into the ointment base. Care should be taken to avoid contact with metallic instruments or containers.

Psoriasis Lotion[40]

Mace Oil	10
Olive Oil	10
Ammonia	15
Essence of Rosemary	5
Rose Water	5
Lecithin	50
Chloroform	½
Perfume	To suit

Sulfanilamide Emulsion[41]

Sulfanilamide	175 gr.
Cod Liver Oil	4 fl. oz.
Oleic Acid U.S.P.	36 min.
Calcium Hydroxide (Saturated Solution)	8 fl. oz.

Hay Fever Ointment[42]

a.	Lanolin Anhydrous	50
	Yellow Petrolatum	25
	Ethyl Amino Benzoate	5
	Menthol	½
b.	Epinephrin Solution 1:1000	2
	Distilled Water	23

Triturate the ethyl amino benzoate and menthol with a portion of the yellow petrolatum until smooth. Gradually add the remainder of the petrolatum and the lanolin.

Mix the epinephrin solution with distilled water, add this aqueous solution slowly under trituration to *a* and mix until homogeneous.

Disinfectant Emulsion[48]

Orthophenyl Phenol	10–40
Terpene Ether	15
Sulfonated Castor Oil	To make 100

REFERENCES

[1] Colloid Chem. Labs., Jersey City, N. J.
[2] Colloid Chem. Labs., Jersey City, N. J.
[3] Bennett, Chem. Formulary, Vol. 1, p. 379 (1933).
[4] Bennett, Chem. Formulary, Vol. 4, p. 114 (1939).
[5] Bennett, Chem. Formulary, Vol. 3, p. 126 (1936).
[6] Bennett, Chem. Formulary, Vol. 3, p. 125 (1936).
[7] Bennett, Chem. Formulary, Vol. 4, p. 115 (1939).
[8] Bennett, Chem. Formulary, Vol. 3, p. 125 (1936).
[9] Bennett, Chem. Formulary, Vol. 3, p. 125 (1936).
[10] Bennett, Chem. Formulary, Vol. 1, p. 379 (1933).
[11] Personal Communication.
[12] Personal Communication.
[13] Personal Communication.
[14] Personal Communication.
[15] Personal Communication.
[16] Bennett, Chem. Formulary, Vol. 3, p. 109 (1936).
[17] Bennett, Chem. Formulary, Vol. 2, p. 371 (1935).
[18] Bennett, Chem. Formulary, Vol. 4, p. 51 (1939).
[19] Bennett, Chem. Formulary, Vol. 4, p. 51 (1939).
[20] J. Am. Pharm. Assoc., XXIV, p. 1068.
[21] J. Am. Pharm. Assoc., XXIV, p. 1068.
[22] J. Am. Pharm. Assoc., XXIV, p. 1068.
[23] Bennett, Chem. Formulary, Vol. 3, p. 101 (1936).
[24] Bennett, Chem. Formulary, Vol. 1, p. 379 (1933).
[25] Bennett, Chem. Formulary, Vol. 1, p. 379 (1933).
[26] Bennett, Chem. Formulary, Vol. 1, p. 380 (1933).
[27] Bennett, Chem. Formulary, Vol. 3, p. 101 (1936).
[28] Bennett, Chem. Formulary, Vol. 2, p. 360 (1935).
[29] Bennett, Chem. Formulary, Vol. 5, p. 70 (1941).
[30] Bennett, Chem. Formulary, Vol. 5, p. 70 (1941).
[31] Bennett, Chem. Formulary, Vol. 2, p. 358 (1935).
[32] Bennett, Chem. Formulary, Vol. 1, p. 383 (1933).
[33] Bennett, Chem. Formulary, Vol. 2, p. 371 (1935).
[34] Bennett, Chem. Formulary, Vol. 1, p. 379 (1933).
[35] Bennett, Chem. Formulary, Vol. 4, p. 81 (1939).
[36] Amer. J. Pharm. III 4 (1939).
[36a] Bennett, Chem. Formulary, Vol. 7, p. 111 (1945).
[37] Bennett, Chem. Formulary, Vol. 4, p. 59 (1939).
[38] Personal Communication.

[39] Bennett, Chem. Formulary, Vol. 5, p. 69 (1941).

[40] Bennett, Chem. Formulary, Vol. 1, p. 142 (1933).

[41] Drug and Cosmetic Industry *50,* 146 (1942).

[42] Bennett, Chem. Formulary, Vol. 1, p. 386 (1933).

[43] U. S. 2,289,476.

CHAPTER XXVI

PAINT EMULSIONS

Formula No. 1[1]

Hydrated Lime	43.0
Hydraulic Cement	19.5
Talc	12.0
Metronite	11.5
Salt	6.5
Mica	5.0
Gum Arabic	1.6
Gum Karaya	0.5
Irish Moss	0.1
Calcium Stearate	0.3

Add water to suit before use.

Formula No. 2[2]

The following mixtures are prepared separately

a.	Potato Starch	10
	Water	30
	Caustic Soda (10° Bé.)	10
b.	Casein	6
	Water	20
	Caustic Soda (10° Bé.)	10
c.	Water	150
	Linseed Oil Varnish	80

These three mixtures can be stirred together into a smooth emulsion which will remain stable for 6–8 months.

Formula No. 3[3]

a.	Casein	30
	Water	150

	Borax	3.5
	Phenol	1
b.	Formaldehyde (40%)	2
	Water	5
c.	Rosin	15
	Linseed Oil Varnish	15
	White Spirit	10

The casein is soaked in hot water; the borax and then the phenol are added. After 24 hours, *b* is mixed in, followed by *c* which had been mixed hot previously. Since the pigments are more easily wetted in oil than in water, it is advisable to grind them with the oil binder *c* before this is emulsified with the casein solution. The amount of pigment averages about 6 to 8 times the amount of the binder. Casein paints thus made excel by their good brushability and increased water resistance.

Formula No. 4[4]

Dehydrated Castor Oil	33.41
Lithopone	39.81
Casein	3.31
Phenol	0.06
Ammonium Hydroxide	23.41

Mix well until uniform; dilute before using.

Formula No. 5[5]

Shellac	30
Ammonium Bisulfate	4.5
Water	65.5

Mix until dissolved and then add

Linseed Oil	30

Emulsify with electric mixer and add

Lithopone	380

Formula No. 6[6]

Water-ground Mica	2 lb.
Lithopone or Titanox	6 lb.

Casein (80 Mesh)	1 lb.
Sodium Fluoride	2 oz.

Formula No. 7[7]

Montan Wax, Double-bleached	7.0
Potassium Oleate	3.0
Potash, Caustic	0.8
Water-soluble Dye	2.0
Water	87.2

The potash, the soap and the dye are dissolved in the boiling water. The boiling solution is then slowly poured into the wax melt adding it in small portions at a time. Care must be taken that a drop in temperature does not cause a separation. It is essential that the mixture be stirred constantly while cooling.

Formula No. 8[8]

Crude wool fat, refined tung oil and rosin, are melted up in the respective proportions of 360 : 40 : 250, the melt being incorporated with 43 parts of ammonia solution, 100 parts alcohol and 1207 parts water and the resulting emulsion agitated till cold. The product, a viscous, yellowish-white emulsion, may be directly employed as a paint.

Formula No. 9[8]

A quick-drying paint comprises 1000 parts of the emulsion, formula No. 8, 80 parts chrome oxide, 150 parts titanium white and 15 parts of a 33% solution of a cobalt-lead-manganese drier.

Formula No. 10[9]

Double-boiled Oil, with Driers	50
Water	45
Sodium Silicate	5
Pigment	50

The oil, which may be diluted if required with 120°F. flash white spirit, should be added to the aqueous phase in a slow stream with rapid and vigorous stirring.

Formula No. 11[10]

a.	Sodium Silicate	10
	Ammonia	10
	Water	10
	Zinc Oxide	5
	Sulfur	3
	Zinc Dimethyldithio-Carbamate	½
b.	60% Latex	100
	Whiting	200
	Spindle Oil	60
	Glue	5

The two solutions are made separately as indicated, and mixed. The more alkaline varieties of sodium silicate cause precipitation of latex by reason of hydrolysis. If, however, ammonia be added to the solution, this increases the OH-ion concentration and prevents splitting of the silicate, so that the latex is thickened and rendered stable.

Formula No. 12[11]

a.	Potato Starch	10
	Cold Water	30
	Caustic Soda (10° Bé.)	10

Mix the starch with cold water and add the caustic slowly in a thin stream till a transparent thick liquid is obtained.

b.	90-Mesh Lactic Casein	6
	Water	20
	Caustic Soda (20° Bé.)	10

Soak the casein in the warm water, not over 130°F., and add the caustic whilst stirring.

c.	Medium Congo Copal	20
	Linseed Oil	50
	White Spirit	30
	Manganese (as Resinate)	0.1
	Linseed Oil Varnish	80
	Water	150

Grind in the required amount of pigment with the oil varnish and then stir in the water. Run the three solutions together through a Hurrel Homogenizer and the resulting emulsion will be stable for a year. If for export to a hot country, it is advisable to add a little preservative, e.g., metachlor-paracresol.

Formula No. 13 [12]

Trihydroxyethylamine Linoleate	0.6
Glue	10.0
Water	32.0
Varnish	16.0
Naphtha	4.0
Sodium Ortho Phenyl Phenate	0.1

Formula No. 14 [13]

Beeswax	70
Japan Wax	44
Montan Wax	25
Shellac	10
Potassium Carbonate	30
Water	730

Boil together and mix well until emulsified. Cool and add *b* with stirring.

Alcohol	40
Trioxymethylene	50

Formula No. 15 [14]

Lithopone	60.0	lb.
Asbestine	20.0	lb.
Mica Vehicle	8.0	lb.
Water	51.0	lb.
Dowicide B	0.45	lb.
Sodium Alginate	1.0	lb.
Raw Chinawood Oil	9.0	lb.
Cobalt Drier 6%	0.48	oz.
Wetting Agent	1.68	oz.

Place the water (preferably from the hot water tap at approximately 100°F.) in the mixer. Add the Dowicide B and stir until dissolved. Add the sodium alginate and stir for a full 20 minutes or until completely dispersed. Add wetting agent and then the chinawood oil (with the drier added to the oil before adding to the water mixture). Stir the oil and alginate mixture for 10 minutes and then add pigment and filler. Stir for one hour. Remove from mixer and put into containers.

Formula No. 16[15]

Sodium Silicate	2	lb.
Soap	½	lb.
Pale Boiled Linseed Oil	¼	lb.
Water, Boiling	1	gal.

Mix very thoroughly. A little alum may be added to increase water resistance.

Formula No. 17[16]

a.	Oiticica Oil	120
	Lead Oxide	6
	Manganese Dioxide	2

Heat to 250°C. and then reduce to 200°C. and add

Potassium Silicate	13
Milk of Lime	16
Water	Sufficient

Agitate violently until cool.

Resin Oil Emulsion[17]

a.	Ester Gum	62
	Bodied Linseed Oil	50
	Pine Oil	21
	Mineral Spirits	62
	Cobalt Linoleate Drier (6% Co.)	1¼
	Lead Linoleate Drier (16% Pb.)	4¼
	Oleic Acid	24
b.	Powdered Casein	27
	Preservative (Moldex)	⅜
	Emulsifier (2-Amino-2 methyl-1-	

propanol)	15
Water	536

Mix the resin, cut in the mineral spirits, with the bodied linseed oil, pine oil, driers, and oleic acid.

Place the casein in mixer, add the water slowly, stirring so that casein is wetted, add the preservative and emulsifier and continue stirring for several minutes.

Add Solution *a* slowly to Solution *b* with constant high-speed agitation until emulsification is complete.

Semi-paste Paints [18]

Formula No. 1

Albalith-335, 332 or 836	790
Ester Gum Oil Emulsion	622

Formula No. 2

Cryptone ZS-830	376
China Clay	230
Ester Gum Oil Emulsion	625

These semi-pastes are designed to be thinned 2 to 1 with water for brush application.

The illustrative formulae of the emulsion and semi-pastes given here can be modified in many ways, but in making substitutions, or changing the percentages of the ingredients, the new system must be balanced or breaking of the emulsion may follow.

"Piccolyte" Oil Emulsion (V-338) [19]

a.	Piccolyte S-100 Resin	27.2
	Lithographic Oil No. 8	22.0
	Pine Oil	9.3
	Mineral Spirits	27.2
	Cobalt Linoleate Drier (6% Co.)	0.5
	Lead Linoleate Drier (16% Pb.)	1.9
	Oleic Acid	11.9

b. Casein B-5	5.2
Moldex or Dowicide A	0.1
2-Amino-2-methyl-1-propanol	2.9
Water	91.8

Dissolve the Piccolyte resin in the mineral spirits and mix with the lithographic oil No. 8, pine oil, driers, and oleic acid.

Place the casein and preservative in a pony or other type mixer, add the water slowly, stirring so that casein and preservative are wetted, add the 2-amino-2-methyl-l-propanol, and continue the stirring for several minutes.

Add solution *a* slowly to solution *b* with constant agitation until emulsification is complete.

"Piccolyte" Oil Emulsion Semi-paste[20]

PIGMENT 54.5%	
Cryptone ZS-830	62
China Clay	38
VEHICLE 45.5%	
Piccolyte Emulsion V-338	93.1
Water	6.9

The pigment, emulsion and water should be mixed together and then milled on a roller or buhrstone mill at a loose setting.

REFERENCES

[1] Schloz, Can. 317,827 (1931).
[2] Hadert, Casein and Its Uses.
[3] Hadert, Casein and Its Uses.
[4] Bennett, Chem. Formulary, Vol. 5, p. 341 (1941).
[5] Bennett, Chem. Formulary, Vol. 5, p. 341 (1941).
[6] Personal Communication.
[7] Bennett, Chem. Formulary, Vol. 4, p. 327 (1939).
[8] Personal Communication.
[9] Bennett, Chem. Formulary, Vol. 1, p. 269 (1933).
[10] Bennett, Chem. Formulary, Vol. 1, p. 269 (1933).
[11] Personal Communication.
[12] Bennett, Chem. Formulary, Vol. 1, p. 270 (1933).
[13] Bennett, Chem. Formulary, Vol. 4, p. 300 (1939).
[14] Bennett, Chem. Formulary, Vol. 4, p. 297 (1939).

[15] Personal Communication.

[16] Bennett, Chem. Formulary, Vol. 3, p. 52 (1936).

[17] N. J. Zinc Co., New York, N. Y.

[18] N. J. Zinc Co., New York, N. Y.

[19] N. J. Zinc Co., New York, N. Y.

[20] N. J. Zinc Co., New York, N. Y.

CHAPTER XXVII

PAPER PROCESSING EMULSIONS

Paper Sizings

Formula No. 1[1]

Paraffin Wax	75
Carnauba Wax	25
Soap	10
Water	To suit

Formula No. 2[2]

Japan Wax	100
Soap	10
Water	40

Boil and stir until homogeneous. This is diluted with boiling water and stirred before use.

Formula No. 3[3]

Rosin	70
Soda Ash	7
Beeswax	2
Water	21

Boil together until a sample solidifies on cooling. This may be shipped solid and is dispersed in hot water when needed.

Formula No. 4[4]

Seven hundred parts of resin are melted with 200 parts of turpentine oil of high boiling point, e.g., that known commercially as Yarmor pine oil, and are stirred into a solution of a caseinate-resin soap emulsifying medium in 1,000 parts of water, preferably using a steam jet or high-speed rotary stirrer. The resin soap is made by adding 100 parts of commercial caseinate powder to 80 parts of powdered resin and a 10 per cent solution of ammonia is added with mild heating to the mixture which is kneaded till saponification is completed and the mixture of swollen ammonium caseinate and ammonium resinate has reached its highest viscosity.

Formula No. 5[5]

Ten parts of soya bean protein are treated with 0.7 part of sodium carbonate by heating to 60°C. under mild agitation with 60 parts of water. To this is added 5 parts of ammonium oleate or other suitable emulsifying agent, such as Turkey red oil, gums like gum arabic, sodium stearate, etc. To this mixture, 40 parts of molten paraffin are slowly run in, under agitation. The mixture of casein, emulsifier, and paraffin is stirred with a high-speed stirrer or other suitable equipment. The time of mixing is usually approximately 15 minutes, the mixture then being diluted with about 1000 parts of water at approximately 60°C. These temperatures can be adjusted according to the melting point of the paraffin used. The emulsion can likewise be made through the use of a colloid mill or other suitable equipment.

Formula No. 6[6]

Rosin	85
Colloidal Clay	15
Water	100
Caustic Soda	2

Formula No. 7[7]

Petroleum Resin	37
Colloidal Clay	18
Casein	1⅕
Caustic Soda	1
Water	To suit

Waterproofing Emulsions for Paper

Formula No. 1[8]

Paraffin Wax	33
Silicate of Soda	4
Alum	2
Glue	1
Water	60

The silicate of soda used in the above formula is a commercial form of syrupy consistency containing about 50% of water. This silicate of soda syrup is mixed with 65% of the water. The remaining 35% of the water is used to dissolve the alum. The glue is added to the diluted silicate of soda. The wax is melted and the silicate of soda solution containing the glue is added with agitation; finally the alum solution is added. The temperature at which the composition is prepared is about 170°F.

Formula No. 2[9]

Paraffin Wax	32.50
Montan Wax	0.85
Silicate of Soda	5.00
Alum	2.75
Glue	0.40
Water	58.50

In this case the silicate of soda specified is a syrup containing about 50% of water. This syrup is diluted with 65% of the water and the alum is dissolved in the remainder of the water employed.

The glue is dissolved in the silicate of soda solution. It is desirable to add 1 or 2% of phenol, based on the amount of glue, in order to preserve the latter. The waxes are melted together and the silicate of soda solution containing the glue is added thereto with thorough agitation, the temperature being about 170°F. The alum solution is then added and agitation continued for a short time.

Formula No. 3 [10]

Paraffin Wax	31.00
Montan Wax	7.00
Silicate of Soda	2.65
Alum	1.35
Water	58.00

Formula No. 4 [11]

Paraffin (130° F.)	22.5
Trihydroxyethylamine Stearate	3.0
Water	74.5

Formula No. 5 [12]

Paraffin Wax	50
Ammonium Stearate	70
Water	980

Formula No. 6 [13]

Trihydroxyethylamine Stearate	4½
Stearic Acid	½
Water	100

Boil and mix until smooth; pour into this slowly while stirring vigorously

Paraffin Wax (Heated to 90–100° C.)	30

Stir until cool.

Use 1 part of above emulsion to 5–10 parts of warm water.

Formula No. 7 [14]

Latex (60%)	50
Paraffin Emulsion (50%)	30
Sodium Silicate	5
Water	30

The paraffin emulsion is diluted with the water and the silicate stirred in. The latex is added last and stirred until homogeneous.

Formula No. 8[15]

Stearic Acid	4 lb.
Japan Wax	5 lb.
Triphenyl Phosphate	8 lb.
Dibutyl Phthalate	1 lb.

Heat to 90°C. and add

Water Shellac (40%)	56 lb.
Triethanolamine	2 lb.

Cool to 70°C. and add successively with vigorous stirring

Ammonia (28%)	1 qt.
Water	3 gal.
Ammonia (28%)	3 qt.
Water	3 gal.
Latex + 4% Sulfur	3 lb.
Water	To make 28 gal.

Emulsion for High Luster Paper

Formula No. 1[16]

Marseilles Soap	2.0
Montan Wax	6.5
Water, Free of Calcium	40.0

Formula No. 2[17]

Yellow Laundry Soap	7 lb.
Carnauba Wax	50 lb.
Water	12½ gal.

Boil with live steam till thoroughly emulsified (from 3–4 hours).

Cool to 35°C. and add

Ammonia (28°)	2 lb.
Cold Water	To make 50 gal.

The emulsion should be allowed to stand for at least 24 hours before use as it seems to improve with age.

Formula No. 3[18]

a.	Dry Castile Soap	12 lb.
	Water	25 gal.
b.	Carnauba Wax	75 lb.

Boil *a* till dissolved; add *b*. Boil 3 hours; cool to 100°F. and add 3 pints 26° ammonia. Make up to 75 gallons with water. This emulsion is added to the casein coating mixture.

De-inking Printed Paper[19]

For separating the cellulosic fibers of filled and printed paper, the paper is beaten in a solution containing sodium hydroxide, sodium metasilicate or sodium phosphate, in such proportion as to give the solution a pH of 9.0–12.6, until the paper has been substantially disintegrated, and an emulsifying agent such as a soap or sulfonated oil is then added to the resulting aqueous suspension and the beating is continued for a short time. The material is filtered through a sieve fine enough to retain the cellulosic fibers but coarse enough to pass the fillers and ink particles.

REFERENCES

[1] Personal Communication.
[2] Bennett, Chem. Formulary, Vol. 1, p. 476 (1933).
[3] Bennett, Chem. Formulary, Vol. 1, p. 475 (1933).
[4] Bennett, Chem. Formulary, Vol. 2, p. 345 (1936).
[5] Bennett, Chem. Formulary, Vol. 2, p. 345 (1936).
[6] Manson, U. S. 1,990,457 (1935).
[7] Paper Makers' Assoc., London (1942).
[8] Bennett, Chem. Formulary, Vol. 2, p. 350 (1935).
[9] Bennett, Chem. Formulary, Vol. 2, p. 350 (1935).
[10] Bennett, Chem. Formulary, Vol. 2, p. 350 (1935).
[11] Bennett, Chem. Formulary, Vol. 2, p. 349 (1935).
[12] Kniffler, U. S. 1,266,955 (1918).
[13] Bennett, Chem. Formulary, Vol. 3, p. 255 (1936).
[14] Bennett, Chem. Formulary, Vol. 2, p. 348 (1935).
[15] Bennett, Chem. Formulary, Vol. 3, p. 255 (1936).
[16] Personal Communication.
[17] Bennett, Chem. Formulary, Vol. 3, p. 254 (1936).
[18] Bennett, Chem. Formulary, Vol. 2, p. 348 (1939).
[19] Bennett, Chem. Formulary, Vol. 2, p. 346 (1935).

CHAPTER XXVIII

POLISH EMULSIONS

Automobile Polishes

Formula No. 1[1]

a.	Acetic Acid (80%) or Lactic Acid	4
	Water	
b.	Spindle Oil, Refined	9
	Rosin Oil	4
	Camphor Oil, Viscous	2
c.	Neuburger Chalk or Tripoli, Finest	7

To solution *a* add the mixture *b*. Stir until homogeneous, and stir in *c*.

Formula No. 2[2]

a.	Ammonium Linoleate	20
	Turpentine	15
b.	Alcohol	5
c.	Water	15
d.	Whiting	45

Dissolve *a*, add *b*, *c*, and ultimately *d*. Mix thoroughly.

Formula No. 3[3]

a.	Carnauba Wax	30
	Glyco Wax B	20
	Naphtha or Varnolene	68
	Turpentine	17
b.	Water	70
	Borax	10

Melt *a* together but do not heat above the boiling point of water. Meanwhile dissolve *b* while heating to boiling, run *a* into *b* slowly while stirring vigorously.

Formula No. 4[4]

Carnauba Wax	120
Kerosene	50
Stearic Acid	15
Oleic Acid	3
Benzaldehyde	6
Triethanolamine	8
Water	To make 825

Melt the carnauba wax, stearic acid and oleic acid. Remove from fire and add the kerosene and the benzaldehyde. Stir thoroughly. Now add a hot solution (80–85°C.) consisting of 240 parts of water and the triethanolamine. Stir well until a smooth emulsion is formed, then add sufficient hot water to make 825 parts. Continue stirring until nearly cool; then bottle.

Formula No. 5[5]

Carnauba Wax	8
Montan Wax	8
Paraffin Wax	4

The waxes are saponified in a hot solution of:

Potash	3
Water	40

Any water of evaporation is replaced with additional warm water. There is then added to this 20 parts of turpentine.

Formula No. 6[6]

a.	Carnauba Wax, Gray	10
	Montan Wax, Bleached	3
	Japan Wax	5
	Scale Wax (50–52°C.)	2
b.	Black Soap	1½
	Water	10
c.	Solvent (Turpentine, White Spirit, etc.)	60

Melt *a* at 95–100°C.; prepare the hot soap solution *b*.

Add *c* with good agitation, and stir until it begins to go heavy (at about 48°C.).

Formula No. 7[7]

a.	Carnauba Wax, Gray	15
	Beeswax or Japan Wax	5
	Glycowax	5
b.	Kaolin or Floated Chalk	30–35
c.	Solvent (Turpentine, White Spirit, or a Mixture of Both and 10 parts of Kerosene)	30
d.	Black Soap	1
	Water	7–10

Melt *a*, stir in *b* very thoroughly; add slowly *c*, with continuous agitation.

Add hot *d* and stir until a paste forms on cooling.

Formula No. 8[8]

a.	Carnauba Wax (N.C.)	500
	Paraffin Wax (50/52°C.)	200
	Beeswax	100
	Colophony	150
b.	Turpentine	4000
	Tetralin	800
	Methyl Hexalin	800
c.	Potash Carbonate	100
	Soft Soap	50
	Water	5000
d.	Neuburg Chalk	600
	Methanol	100

Melt *a*, with stirring, add *b* (which is warmed up to 55°C.); cool for a while, add *c*, and finally *d*.

Formula No. 9[9]

a.	Carnauba Wax	500
	Paraffin Wax (50/52°C.)	200
	Beeswax	200

	Rosin	150
b.	Turpentine Substitute	4000
	Tetralin or Methylhexalin	600–800
c.	Potash Carbonate	100
	Soft Soap	50
	Water	5
d.	Whiting or Neuburg Chalk	600
	Methanol	100

Melt *a,* add the hot solvents *b,* stir until about 55°C., add *c.* When all are mixed thoroughly, add *d.*

Formula No. 10 [10]

Castile Soap	4	oz.
Beeswax (Bleached)	4	oz.
Ceresin Wax (Bleached)	4	oz.
Paraffin Oil	1	pt.
Linseed Oil, Raw	1	pt.
Cedar Oil	1	pt.
Potassium Carbonate	½	oz.
Water	4½	qt.

Shave the soap into cold water, contained in a kettle, and stir in the ceresin, beeswax and potassium carbonate. Heat rapidly until all of the ingredients have dissolved. The batch should be stirred continuously during heating. Turn off the heat. In a separate container mix the linseed oil, paraffin oil and cedar oil together and stir, then add the soap mixture while hot in small quantities at a time.

Stirring should be continued intermittently during cooling to prevent formation of crust. The batch should be periodically stirred during packing.

Formula No. 11 [11]

Castile Soap	3
Beeswax	2½
Shellac, Powdered	2½
Alcohol	4
Sperm Oil	4
Water	To suit

Formula No. 12 [12]

Cellite	75	g.
Isopropyl Alcohol	60.8	cc.
Glycerin	20.8	cc.
Varnolene	28.5	cc.
Camphor Oil	28.5	cc.
Spindle Oil	147.5	cc.
Saponin	6	g.
Water	470	cc.
Bentonite	8	g.
Oxalic Acid	2	g.

Let last four ingredients stand overnight. Then mix in other ingredients in a mayonnaise- or churn-type mixer. Mix intermittently for a few hours.

Formula No. 13 [13]

1. Cellite (or Other Airfloated Abrasive)	282
2. Isopropyl Alcohol	305
3. Glycerin	50
4. Naphtha	110
5. Camphor Oil	105
6. Spindle (Mineral) Oil	555
7. Oxalic Acid	10
8. Suspensone	22
9. Water	1770
10. Emulsone B	10

1, 8, 9, and 10 are mixed and allowed to stand overnight. Then add 3 and stir. Next add 7 and 2 and stir vigorously. Now add 4, 5 and 6 slowly while stirring vigorously. Continue stirring intermittently for 2 hours. Allow to stand overnight and stir for ½ hour the next day. If a thinner product is wanted, reduce Emulsone B to 5 lb.

Formula No. 14 [14]

To 3½ gal. of pale blown castor oil, add ¾ gal. of orthodichlorbenzol. This is mixture No. 1. To 15 gal. of water, add 11 gal. of neutral pale mineral oil and ¾ gal. of ammonia, which has been previously made up of one part of ammonia of 26° Bé. and 4 parts of water. This is mixture No. 2. Mixture No. 1 and mixture No. 2 are combined and agitated for about 5 minutes. Three and one-half gallons of special petroleum spirit is added and the whole mass is now stirred about 10 minutes. It is then run through a colloid mill and is ready for use. Alternately, all of the ingredients may be mixed in a single batch and passed through the colloid mill, which breaks up the particles to a fine degree. This obviates preparing separate mixtures.

Formula No. 15[15]

Kieselguhr	8
Paraffin Wax	8
Methylated Spirit	2
Glycerin	2
Water	40
Gum Tragacanth	¼

Formula No. 16[16]

Kieselguhr (Levigated)	11
Silica (Levigated)	9
Yellow Ochre	1
Red Ochre	1/10
Kerosene	16
Soft Paraffin Wax	2
Powdered Soap	1

Formula No. 17[17]

Mineral Oil, White	35
Beeswax	5
Carbon Tetrachloride	10
Kieselguhr	3
Oleic Acid	3
Potash Carbonate	½
Ammonia	½
Water	43

Formula No. 18[18]

a.	Montan Wax, Bleached	3.0
	Carnauba Wax Residues	4.0
	Yellow Beeswax	1.5
	Japan Wax	1.5
	Glycowax	1.0
b.	Potash Carbonate	0.2
	Borax	0.3
	Black Soap	0.5
	Water	35.0
c.	Kerosene	10.0
	Turpentine	10.0

Melt *a* at about 100°C., and add *b*, of equal temperature, to it with very good agitation. Watch closely to prevent foaming over; carbon dioxide is formed. Keep boiling untii the saponification is finished; add *c*. Stir until cold.

Formula No. 19[19]

Naphtha	2½	pt.
Mineral Oil	2½	pt.
Diglycol Laurate	4	pt.
Ammonia	1	oz.
Water	1	pt.

Formula No. 20[20]

Oleic Acid	80
Liquid Paraffin	250
Potassium Hydroxide	16
Tragacanth	6
Water	To make 1000

Mix the oleic acid with the paraffin and slowly add the potassium hydroxide, previously dissolved in 200 parts of water. Soak the tragacanth in 500 parts of water until fully absorbed; heat to boiling, and when cool stir into the above emulsion.

Formula No. 21 [21]

Oleic Acid	2	lb.
White Mineral Oil	12	lb.
Carnauba Wax	2½	lb.
Yellow Beeswax	2	lb.
Water	28	lb.
Triethanolamine	13	oz.
Infusorial Earth	100	lb.
Gum Tragacanth	4	lb.

Take the carnauba wax, beeswax, oleic acid and white mineral oil and melt at gentle heat. In another vessel heat to near boiling point the water and the triethanolamine. Add the oil-wax mixture to the water mixture in a slow stream under steady stirring and retain at near boiling temperature until a smooth emulsion has been formed. Then remove from fire and continue stirring until nearly cold. Now add to the emulsion the infusorial earth, mix well and let dry until all the water has been expelled. Add the powdered gum tragacanth, mix thoroughly, and sift. Eight to 12 ounces of the powder are sufficient to make 1 gal. of polish by merely adding sufficient water.

Formula No. 22 [22]

a.	Olein	10 cc.
	Mineral Oil	20 cc.
	Petroleum	20 cc.
	Turpentine Oil or White Spirit	28 cc.
b.	Alcohol	6 cc.
	Ammonia (Sp. Gr. 0.910)	6 cc.
c.	Infusorial Earth	10 g.

Formula No. 23 [23]

Olein, Distilled	15
White Spirit (Lacquer Benzoline)	90
Chalk, Neuburg, Fine	45
Ammonia, 25%	1

Saponify this mixture adding the ammonia with thorough agitation.

Formula No. 24 [24]

Paraffin Oil	20.0
Blown Castor Oil	2.0
Kieselguhr	4.0
China Clay, Colloidal	1.0
Tragacanth, Gum	0.6
Sodium Benzoate	0.2
Water	72.2

Formula No. 25 [25]

Soap	20
Kieselguhr	10
Kaolin	15
Iron Oxide	5
Mineral Oil	5
Naphtha	5
Water	40

Formula No. 26 [26]

Sulfonated Olive Oil (30%)	10
Mineral Oil	30
Pumice Powder	5
Amyl Alcohol	10
Carnauba Wax (Powdered)	5
Water	40

Mix the oils, wax and alcohol; add the water slowly with good stirring; mix in other ingredients.

Formula No. 27 [27]

Turpentine	25
Naphtha	15
Oleic Acid	10
Kaolin	15
Whiting	15
Iron Oxide	5
Mineral Oil	2

Water	10
Triethanolamine	3

Formula No. 28[28]

Turpentine	38½
Oleic Acid	15
Kaolin	20
Kieselguhr	5
Iron Oxide	5
Mineral Oil	5
Water	10
Potash, Caustic	1½

Formula No. 29[29]

Water	55
Glue, Pale	6
Lactic Acid	3
Sand, Finely Sifted, 0000, or Silver-Tripoli, or Kieselguhr	7
Turpentine	15
Spindle Oil, Thin	14
Perfume (Pine Needle Oil, or Similar Oil)	To suit

Formula No. 30[30]

a. Water-soluble Oil	35
Tall Oil	30
b. Caustic Soda (38° Bé.)	8
c. Water-soluble Oil	25
Kerosene	15
d. Water	5–10
e. Turkey Red Oil	5– 7

Mix *a,* add *b* at 70°C., very slowly with agitation. Boil. When saponified, add *c* and *d* while hot, with stirring; *e* may be added if desired.

Formula No. 31[31]

a. Oleic Acid	5.0
Rosin (In Small Pieces)	6.0

Alcohol	
b. Caustic Soda (38° Bé.)	2.5
c. Kerosene	70.0
Turkey Red Oil	8.0
d. Water	5–10.0

Heat *a* with the amount of alcohol desired. Mix well, and add *b* at about 70°C. Add *c* with continuous agitation. The *d* may be added if desired.

Formula No. 32[32]

Wax	25.0
Stearic Acid	2.5
Potash, Caustic	2.5
Turpentine	20.0
Water	To make 100.0

Formula No. 33[33]

Wax	20.0
Stearic Acid	2.5
Ammonia (Sp. Gr. 0.88)	2.0
Triethanolamine	1.5
Turpentine	25.0
Water	To make 100.0

Formula No. 34[34]

White Mineral Oil	80
Deodorized Mineral Oil	9
Stearic Acid	9
Triethanolamine	4
Methanol	4
Water	120

Mix the white oil and mineral oil and add the stearic acid. Heat the mixture to about 140°F. at which time the stearic acid will dissolve to give a clear solution. In a separate container mix the triethanolamine, methanol and water and heat to about 140°F. Then add the first mixture to this and stir vigorously until the emulsion is smooth. Continue to stir gently until cool.

Formula No. 35 [35]

a.	White Oil	20
	Castor Oil	10
	Solvent Naphtha	5
	Glycerin	5
	Turpentine	15
	Diglycol Laurate	2½
b.	Water	100
	Neuburg Chalk	25
	Kaolin, Finest	5
	Bentonite	3

Make mixtures *a* and *b*, and add *a* to *b*. Homogenize, if desired.

Formula No. 36 [36]

White Spirit	2½	pt.
Mineral Oil	2½	pt.
Turkey Red Oil	4	pt.
Fullers' Earth	8	oz.
Bentonite	6	oz.
Ammonia	1	oz.
Water	5	pt.
Glycerin	1	pt.
Formaldehyde	8	oz.

Mix the oils together first and add the abrasive powders, then the water, ammonia, glycerin, and formaldehyde; stir rapidly until a smooth mixture is obtained.

Formula No. 37 [37]

a.	Yellow Beeswax or Montan Wax, Refined	36.0
b.	Potash Carbonate	3.0
	Water	140.0
c.	Turpentine or Substitute	10.5

Melt *a* carefully; add slowly a boiling solution *b*, boil until the saponification is completed. Cool, thin with *c*.

Formula No. 38 [38]

Yellow Wax	10
Air-floated Tripoli	18
White Spirit	19
Soft Soap	½
Water	2½

Melt the wax in a double pan and add the powder slowly; keep stirring while slowly adding the white spirit. Dissolve the soft soap in the water and add to the mix with constant stirring. On cooling this forms a soft paste.

Formula No. 39 [39]

Yellow Wax	20
Commercial Silica, Very Finely Powdered	40
Turpentine Substitute	40
Soft Soap	1
Water	5

Melt the wax and incorporate the powder, slowly adding the turpentine substitute; stir in the soap, previously dissolved in the water. The soap has a slight softening effect in yielding a higher and better polish. The paste may be tinted with ferric oxide.

Floor Polishes

Formula No. 40 [40]

Aquamel	15
Carnauba Wax	25
Water	225

Heat the wax and Aquamel together till a clear jelly is obtained. Add the water which must be as near boiling as possible. Stir thoroughly till cool.

Formula No. 41 [41]

Carnauba Wax	10.0
Triethanolamine	1.4

Oleic Acid	1.4
Borax	1.0
Refined Shellac	1.4
Ammonium Hydroxide	0.2
Water	To make 100.0

Formula No. 42[42]

A stable emulsified floor wax can be obtained with 40% of a mixture of 1 part of beeswax, 1 part of paraffin, 1% of soap, 0.33% of soda ash, and 2.6–2.7% of methyl cellulose. The soap and soda ash are dissolved in boiling water, and an aqueous 5% solution of methyl cellulose added. This is warmed and the melted wax added. The product is then stirred while cooling to give a good emulsion.

Formula No. 43[43]

Sixty-three parts of a 5% aqueous solution of methyl cellulose are mixed into 1 part of potassium carbonate and 3 parts of soap dissolved in 37 parts of boiling water. The mixture is cooled to 70°C. and 100 parts of a melted mixture containing 1 part of beeswax, 1 part of paraffin and 8 parts of ceresin added. Heating is continued for a half hour; the mixture is stirred well; the amount of water which has evaporated is replaced, and 96 parts of white spirit or turpentine substitute are gradually added. The whole is stirred until cool.

Formula No. 44[44]

Beeswax (Yellow)	5	lb.
Paraffin Wax	4	lb.
Soap Chips	3	lb.
Stearic Acid	3	lb.
Turpentine	3	gal.
Salts of Tartar	1½	lb.
Water	3½	gal.

Dissolve salts of tartar and soap in boiling water. Melt waxes in another container and heat to 200° F., and add the boiling water soap solution slowly with vigorous stirring until homogeneous. Turn off heat and run turpentine in slowly with good stirring. Pack in cans when cold.

Formula No. 45[45]

Carnauba Wax	6.0
Beeswax	4.0
Ceresin	4.0
Turpentine	70.0
Trichlorethylene	2.0
Oleic Acid	7.0
Triethanolamine	2.5
Water	75.0
Petroleum	40.0

Formula No. 46[46]

Carnauba Wax	33
Beeswax	66
Turpentine or White Spirit	225
Soap	1
Water (Hot)	10

The soap is dissolved in the hot water and the waxes are dissolved in the turpentine. When cool, the solutions are mixed with vigorous shaking or stirring.

Formula No. 47[47]

Carnauba Wax No. 2	10
Candelilla Wax	10
Oleic Acid	3
Triethanolamine	4
Borax	1½
Water	185

Formula No. 48[48]

Carnauba Wax	60	oz.
Dry Castile Soap	15¼	oz.
Oleic Acid	2¾	oz.
Caustic Soap	1½	oz.
Water	To make 4	gal.

Heat the wax, soap, and acid to 100°C. While stirring rapidly, slowly add the caustic dissolved in the water, heated to 80°C.

Bright-drying (Rubless) Floor Polish Emulsions

Formula No. 1 [49]

Carnauba Wax No. 2	120.0
Oleic Acid	13.7
Trigamine	19.0
Caustic Soda (47%)	3.5
Water	843.5

Melt the wax in the oleic acid, add Trigamine and heat to 90°C. Add the caustic soda and 25 cc. of water at about 95°C. Stir until jell is formed. Then add the rest of the water which must be boiling. Stir thoroughly till cool.

Formula No. 2 [50]

Carnauba Wax	120
Oleic Acid	20
Trigamine	20
{Caustic Soda (50%)	8
{Water	32
Water	800

Formula No. 3 [51]

Carnauba Wax	13.20
Oleic Acid	1.50
Triethanolamine	2.10
Borax	1.00
Water	108.00
Shellac	2.20
Ammonia (28%)	0.32

Formula No. 4 [52]

Carnauba Wax No. 1	10	g.
Ammonium Linoleate Paste	3	g.
Borax	2	g.
Water	90	cc.

Turpentine	1 cc.
Pine Oil	¼ cc.

Heat the wax, turpentine and oil to 100°C. in a jacketed vessel fitted with a high-speed stirrer. To this add slowly the paste, borax, and water previously heated to 100°C. Stir vigorously until emulsified.

Formula No. 5[53]

Carnauba Wax No. 1	20 g.
Ammonium Linoleate Paste	8 g.
Ammonium Hydroxide	7½ cc.
Water	180 cc.
Ammonium Hydroxide	7½ cc.

Heat the wax to 100°C. in a jacketed vessel fitted with a high-speed stirrer and to it add slowly the paste, water and 7½ cc. of the ammonium hydroxide dissolved and heated to 80°C. As soon as it is emulsified add the balance of the ammonium hydroxide, while stirring vigorously.

Formula No. 6[54]

Carnauba Wax	13.2
Duponol G	2.0
Borax	1.0
Shellac	2.0
Ammonia (28%)	0.3
Water	81.5

Melt together, in a steam-jacketed vessel, the carnauba wax and Duponol G. While stirring, add the borax, dissolved in 1% of the water (boiling) and stir until homogeneous. After a homogeneous emulsion is formed turn off the steam and stir slowly until cooled to room temperature.

Formula No. 7[55]

a. Carnauba Wax	11.2
Oleic Acid	2.4
Morpholine	2.2

	Water	67.0
b.	Shellac	1.5
	Morpholine	0.2
	Water	15.5

Melt the carnauba wax carefully with the oleic acid and maintain the temperature closely at 90°C. Stir until well mixed, add the morpholine, and stir constantly until the whole mass is quite clear. In the meantime, the water should have been brought to a simmer in a separate kettle. Add it slowly to the hot wax mixture with steady stirring, making certain that each small portion is well incorporated before further addition. The mixture becomes increasingly viscous and should be of the appearance of petrolatum when two-thirds of the water has been added. After this stage has been reached, the mixture begins to thin out and the remainder of the water may be added rapidly. The total time for adding the water should be 30–40 minutes. A steam-jacketed kettle and a hand-operated paddle, or slow-speed, large-bladed propeller are recommended for successful production.

Allow the mixture to cool. While slowly stirring, add the shellac solution. This has been made by warming together the morpholine, water and shellac indicated in *b* above and filtering if necessary.

Formula No. 8 [56]

Carnauba Wax	64.8
Paraffin Wax	7.2
Morpholine	14.4
Oleic Acid	15.3
Boiling Water	430.0
Cold Water	100.0

Formula No. 9 [57]

Carnauba Wax No. 1 Yellow	30
Water	210
Triethanolamine	3
Oleic Acid	5

Melt the wax and the oleic acid in boiling water bath. When the mixture is homogeneous, add the triethanolamine and stir until it is all uniformly incorporated.

Heat the water to boiling and add it slowly, portion by portion, permitting each addition to be well agitated before the next addition. As the first additions of water are made, the mixture thickens considerably and becomes gel-like in consistency. As more water is added, the mixture becomes creamy. When still more water is added, it turns into a watery emulsion. During the gel and cream stage, it is very important that the addition of water be made carefully and efficient agitation be used in order to obtain a thoroughly homogeneous mass. It is just as detrimental to add the water too slowly as too fast. Equally as important as efficient agitation and careful addition of water is the maintenance of high temperatures during the process.

Make a Manila resin solution as follows:

Manila DBB	30
Water	158
Ammonium Hydroxide (28–29%)	12

Powder the resin and agitate it with water and the ammonia until all the resin is dissolved. Strain the solution.

Prepare the finished polish as follows:

Carnauba Wax Emulsion	34
Manila DBB Solution	39

Mix well, using stirring.

Formula No. 10[58]

Paraffin Wax	15
Oleic Acid	15
Triethanolamine	20
Borax } Previously Dissolved	7½
Water }	7½

Warm together to 90°C. and mix with an electric mixer. While keeping at 90–100°C. and stirring vigorously add the following which must be at 90–95°C.

Carnauba Wax	100
Water	1000

Cool quickly and package.

Formula No. 11 [59]

Carnauba Wax	30
Rosin	6

Heat above to 140°C., cool to 100°C. and add the following which has been heated to 95–100°C., with vigorous stirring:

Soap Flakes	10
Turpentine	1
Water	270

Formula No. 12 [60]

Carnauba Wax No. 1 Yellow	30
Thermally Processed Congo	30
Sodium Hydroxide	½
Water	420
Triethanolamine	4
Oleic Acid	9

Melt the wax and add the congo at about 125°–150°C. When the mixture is homogeneous, put it in a boiling water bath. Add the oleic acid slowly and with vigorous stirring. Do the same with the triethanolamine. Dissolve the sodium hydroxide in 25 parts of water. Heat the solution to its boiling point and add it slowly to the mixture still in the boiling water bath, using vigorous stirring. When the mixture is thoroughly homogeneous, add the remainder of the water, also at its boiling point, and also with vigorous stirring.

Formula No. 13 [61]

Rilan Wax	10
Japan Wax	10
Paraffin Wax	5
Soda	2
Water	100

Formula No. 14 [62]

Montan Wax, Bleached	8
Soft Soap	2
Rosin	1
Potash	1
Water	85

Formula No. 15 [63]

Montan Wax, Bleached	5.6
Japan Wax	3.0
Paraffin (50–52°C.)	4.0
Curd Soap or Soft Soap	2.0
Potash	1.5
Water	55.0
Solvent	25–30

Formula No. 16 [64]

Thirty-five parts spindle oil and 30 parts tall oil are mixed and warmed to about 70°C.; 8 parts of caustic soda solution, 38° Bé., are slowly added with constant stirring and boiled until saponification takes place. Then 25 parts of spindle oil and 15 parts of kerosene are added, as well as 5–10 parts of hot water.

Formula No. 17 [65]

Olein	5
Resin	6
Alcohol	2

The mixture is melted and mixed, with stirring, at about 70°C. with 2.5 parts of caustic soda solution, 38° Bé.; then add and mix in turn

Kerosene	70
Turkey Red Oil	8
Water	5–10

Furniture Polishes

Formula No. 1[66]

a.	Bleached Beeswax	2
	Carnauba Wax	6
	Halowax No. 1013	4
	Turpentine	20
b.	Stearic or Oleic Acid	3½
	Triethanolamine	1½
	Water	63
c.	Perfume	To suit

Melt the three waxes and add the turpentine with agitation. Prepare a soap solution by heating the triethanolamine dissolved in the water almost to boiling and add the molten stearic acid or oleic acid. The soap may also be prepared by heating the triethanolamine and water with stearic acid in powdered form. Run *a* into *b* with agitation. Continue to agitate until cool. Add *c*. If properly made the emulsion is stable.

Formula No. 2[67]

Blendene	20
Spindle Oil	40
Perilla Oil	20
Varnolene	40
Water	120
Borax	2

Formula No. 3[68]

Carnauba Wax	30
Beeswax	15
Ceresin Wax	15
Turpentine	26
Naphtha	24
Stearic Acid	8
Triethanolamine	4
Water	65

Formula No. 4[69]

Carnauba Wax	10.0
Beeswax	4.0
Ceresin Wax	4.0
Naphtha	80.0
Stearic Acid	8.0
Triethanolamine	4.5
Water	200.0

Formula No. 5[70]

Carnauba Wax, Bleached	6
Japan Wax	3½
Paraffin Wax	1½
Turpentine	12
White Curd Soap	3
Rosin, Pale	2
Water	30
Clove Oil	Trace

Formula No. 6[71]

Carnauba Wax	6.0
Paraffin Wax	9.0
Ceresin	2.0
Naphtha	43.0
Turpentine	4.0
Stearic Acid	1.0
Trihydroxyethylamine Stearate	4.5
Water	130.0

Formula No. 7[72]

a.	Carnauba Wax	60
	Turpentine	60
	Stearic Acid	2
b.	Trihydroxyethylamine Stearate	12
	Water	62

Heat *a* and *b* in separate vessels to 200°F. and run *b* into *a* slowly with vigorous stirring. Stop when homogeneous.

Formula No. 8[73]

Diglycol Stearate	10 oz.
Paraffin Oil	3 pt.
Water	4 gal.
Lemon Odor (Lemenone)	2 oz.

The oil and diglycol stearate are heated together to 150°F. until the wax has melted. The hot wax mixture is then run into the water which has previously been heated to about 200°F., with rapid stirring. Stirring should be continued until the batch has cooled. The lemon odor is added after the batch has partially cooled.

Formula No. 9[74]

Mineral Oil	30	fl. oz.
Kerosene	10	fl. oz.
Turpentine	4½	fl. oz.
Stearic Acid	4½	oz.
Triethylamine	2	oz.
Wood Alcohol	2	fl. oz.
Water	60	fl. oz.

Mix the mineral oil, turpentine and kerosene, to the stearic acid and heat to about 148°F. to melt and dissolve the stearic acid. This should produce a clear solution.

In another container the triethylamine, alcohol and water are mixed and heated to 148°F. This mixture is then added to the first hot solution and the whole stirred vigorously for 15 minutes to produce a smooth creamy and white emulsion. The stirring should be brisk. Care should be taken in handling turpentine and kerosene because of their inflammability. Gentle stirring should be continued until the product is cool.

Formula No. 10[75]

Naphtha	10
Thin Mineral Oil	72
Perilla Oil	30
Nelgin	7
Water	88

Soak Nelgin in water for a few hours. Stir until dispersed. To this add the oil mixture slowly with rapid stirring.

Formula No. 11[76]

a.	Oleic Acid	2
	Kerosene	4
	Sulfonated Castor Oil	2
b.	Water	1¾
	Sodium Hydroxide	1/20
	Triethanolamine	1/10

Mix *a* thoroughly. Mix *b* and pour into *a* while stirring at high speed. Continue to stir until batch is of uniform creamy consistency.

Formula No. 12[77]

Paraffin Oil	20
Red Oil	5
Soft Soap	3
Gum Arabic	2
Water	70

Mix vigorously until completely emulsified.

Formula No. 13[78]

Raw Linseed Oil	10
Spindle Oil	50
Stoddard Solvent	15
Xylol	5
Soft Soap	1
Water	19

Formula No. 14[79]

Spindle Oil	40 g.
Perilla Oil	20 g.
Trigamine Stearate	30 g.
Denatured Alcohol	10 cc.
Varnolene	120 cc.
Water	120 cc.
Borax	2 g.
Lemenone	5 cc.

Formula No. 15 [80]

Turpentine	8 gal.
Naphtha	30 gal.
Light Spindle Oil	49 gal.
Acetic Acid (36%)	6 gal.
Water	100 gal.
Antimony Chloride	4 gal.
Gum Arabic	10 lb.
Gum Tragacanth	10 lb.
Perfume	1 gal.

Make up with water to 200 gal. and run through colloid mill.

Formula No. 16 [81]

Yellow Ceresin	3 lb.
Japan Wax	1 lb.
Beeswax	2 lb.
Linseed Oil, Raw	4 gal.
Turpentine	1 gal.
Paraffin Oil (28°)	1 gal.
Water	7 gal.
Carbonate of Potash	3 oz.
Soap Chips (Animal Fat Soap)	1 lb.

Mix the above thoroughly.

Formula No. 17 [82]

Water	10
Nut Oil	1
Mineral Oil	1
Acetic Acid	⅛
Gum Arabic	11

Formula No. 18 [83]

White Mineral Oil	2
Kerosene	4
Sulfonated Castor Oil	1
Water	4
Perfume Oil	To suit

The kerosene and mineral oil are mixed and the sulfonated castor oil is added, while mixing vigorously. Next run in the water while mixing briskly. Finally add the perfume in the proportions of about ½ oz to each gallon of polish.

Formula No. 19[84]

a.	Montan Wax, Double Bleached	4
	Beeswax	5
b.	Soft (Potash) Soap	1
	Potassium Carbonate	3
	Water	82
c.	Ammonia (Sp. Gr. 0.910)	5

Melt *a,* boil up with *b*, and stir until a smooth emulsion has formed. Cool. Add *c.*

Formula No. 20[85]

Crude Montan Wax	5
Beeswax	4
Soft Soap	1
Potassium Carbonate	3
Water	87

Boil all ingredients together until a smooth emulsion has formed. Stir cold.

Leather Polishes

Formula No. 1[86]

Carnauba Wax	5.0
Montan Wax, Bleached	5.0
Beeswax	2.0
Japan Wax	1.0
Paraffin Wax	12.0
Potash	1.7
Water	72.0

Formula No. 2[87]

Montan Wax, Bleached	10
Rosin	2

Japan Wax	1
Diglycol Stearate	1
Paraffin (50–52°C.)	13
Potash	2⅕
Water	70

Formula No. 3[88]

Carnauba Wax	12
Stearin	3½
Triethanolamine	1
Water	17–20
Turpentine	12–15

Formula No. 4[89]

Carnauba Wax	11
Turpentine	16
Stearic Acid	3
Oil-soluble Nigrosine	2
Triethanolamine	1
Water	66
Water-soluble Nigrosine	1

Formula No. 5[90]

Water	20	gal.
Potassium Oleate	7½	lb.
Trisodium Phosphate	½	lb.
Beeswax, Yellow	6	lb.
Carnauba Wax	6	lb.
Turpentine	4½	gal.
Pine Oil	½	gal.
Terpineol	¼	gal.

Formula No. 6[91]

Mineral Spirits	169.00
Light Mineral Oil	187.50
Glyceryl Monoricinoleate	93.60
Ricinoleic Acid	11.03
Water	642.35
Potassium Hydroxide	1.65

The potassium hydroxide is dissolved in one-third of the total water. The ricinoleic acid is then added and after the required stirring soap is formed. The glyceryl monoricinoleate is added, followed by the mineral oil, and in turn by one-half of the remaining water. Mineral spirits are added and finally the remaining water. The entire mixture after thorough agitation is then sent through an homogenizer to produce a commercial dispersion.

Formula No. 7 [92]

Beeswax	1 lb.
Ceresin Wax	1 lb.
Carnauba Wax	6 oz.
Turpentine	3 pt.
Yellow Soap	6 oz.
Oil-soluble Black	Enough to color
Water	Sufficient

Shave the soap and dissolve in the smallest possible quantity of water by means of heat; melt the waxes together, add the turpentine and stir well. Add the black dye and stir in the soap solution, continuing to stir until cold.

Formula No. 8 [93]

a.	Beeswax	100
	Paraffin Wax	20
	Carnauba Wax, Gray	8
	Naphtha	80
	Turpentine	70
b.	Water	200
	Potassium Carbonate, Calcined	6
	Glue	35

Formula No. 9 [94]

Wax Mass

Bleached Carnauba Wax	10.0 kg.
Japan Wax	5.0 kg.
Bleached Beeswax	2.0 kg.
Pale Rosin	0.5 kg.

Bleached Montan Wax	3.0 kg.
Stearin	0.5 kg.

Saponifying Solution

White Tallow Curd Soap	0.75 kg.
Potassium Carbonate	1.50 kg.
Caustic Soda (36° Bé.)	0.25 kg.
Water	35.00 kg.
Turpentine	1.00 kg.

Dye Solution for Dark Reddish-brown Cream
(per 100 kg. of above mass)

Brown R	350 g.
Mars Red	250 g.
Nigrosin G	15 g.
Water	40 kg.
Tartrazine X	50 g.

Formula No. 10[95]

Carnauba Wax	6
Ceresin Wax	3
Candelilla Wax	3
Turpentine	5
Lemongrass Oil	½
Light Mineral Oil	1
Diglycol Stearate	5

Heat below 90°C. and stir till clear. Pour slowly, while stirring, with high speed into

Water (Boiling)	100

Stir until temperature falls to 70°C.

Formula No. 11[96]

Carnauba Wax	7.5
Marseilles Soap	1.0
Potassium Carbonate	1.5
Water	79.0

Melt the carnauba wax, and add the heated mixture of the other ingredients. Stir rapidly, and add 11 parts nigrosine previously dissolved in a small amount of the soap solution.

Formula No. 12[97]

Carnauba Wax	30	g.
Paraffin Wax	45	g.
Ozokerite	10	g.
V.M.&P. Naphtha	215	cc.
Turpentine	20	cc.
Stearic Acid	20	g.
Triethanolamine	7½	g.
Water	650	cc.
Oil-soluble Black	15	g.
Water-soluble Black	5	g.

Formula No. 13[98]

Carnauba Wax	6
Ceresin Wax	3
Candelilla Wax	3
Turpentine	5
Lemongrass Oil	½
Light Mineral Oil	1
Diglycol Stearate	5

Heat below 90°C., and stir until clear. Pour slowly, while stirring with high speed, into

Water (Boiling)	100

Stir until the temperature falls to 70°C. The finished product is snow white, applies easily and rubs to a high gloss. If a paste polish is desired reduce the water to about 50 to 60 parts. If a colored paste is desired an aniline dye is dissolved in the water used.

Formula No. 14[99]

Pale Carnauba Wax	10.0
Japan Wax	4.5
Bleached Montan Wax	3.0
Rosin	0.5

Curd Soap	0.8
Potash	1.5
Caustic Soda Solution	0.2
Water	40.0
Turpentine	2.0
Water	30.0

Formula No. 15[100]

Bleached Montan Wax	14
Carnauba Residues	7
Japan Wax	3
Potash	2½
Water	75
Turpentine	2

Formula No. 16[101]

Pure Carnauba Wax	2.0
Japan Wax	5.0
Carnauba Wax Residues	13.0
Paraffin Wax	1.0
Curd Soap	0.7
Potash	2.5
Water	65.0

Formula No. 17[102]

Montan Wax	45
Beeswax	3
Carnauba Wax	3
Paraffin Wax (50–52°C.)	16
Rosin	12
Potash	15
Water	300
Curd Soap	2
Water	70

Formula No. 18[103]

Montan Wax	5.0
IG Wax O. P.	2.5
IG Wax E.	1.0
Japan Wax	0.5
Rosin	1.5

Paraffin Wax (50–52°C.)	1.5
Potash	1.5
Water	85.0

Formula No. 19[104]

Rilan Wax	8.0
Diglycol Stearate	5.0
Montan Wax, Bleached	7.0
Beeswax	3.0
Paraffin Wax (50–52°C.)	7.0
Rosin	0.5
Curd Soap	0.5
Potash	0.5
Water	80.0

Formula No. 20[105]

Carnauba Wax	12.50
Paraffin Wax (50–52°C.)	1.00
Rosin	2.50
Diglycol Stearate	1.50
Borax	0.75
Potash	2.50
Water	75.00

Formula No. 21[106]

Carnauba Wax	85
Stearin	9
Triethanolamine	4
Water	400

The stearin is melted and the triethanolamine, dissolved in hot water, is added at about 70°C. and then the whole stirred and heated to 100°C. Into this solution the melted carnauba wax, heated to 80–90°C., is stirred, and the stirring continued until the whole mass has cooled.

Formula No. 22[107]

Montan Wax, Bleached	20
Japan Wax	7
Carnauba Wax Residues	3

Paraffin Wax (50–52°C.)	5
Rosin	2
Potash	2
Borax	½
Curd Soap	2
Water	40
Turpentine or White Spirit	20

Formula No. 23[107]

Montan Wax, Bleached	7.5
Carnauba Wax Residues	12.0
Japan Wax	6.0
Paraffin Wax	5.0
Rosin	1.0
Curd Soap	1.5
Potash	1.0
Water	40.0
Water	5.0
Ammonia (Sp. Gr. 0.910)	0.5

Formula No. 24[108]

Montan Wax, Bleached	6
Carnauba Wax	3½
Beeswax	3
Japan Wax	2
Paraffin Wax (50–52°C.)	4
Rosin	½
Curd Soap	½
Potash	¾
Water	50
Turpentine	28

Formula No. 25[109]

a. Carnauba Wax	8
Montan Wax	8
Paraffin Wax	4

These are saponified in a hot solution of

Potash	3
Water	50

Replace any evaporation with additional warm water.

b.	No. 1 Polish Black	4
	Water	25

These should be milled in a color mill until thoroughly dispersed.

While *a* is hot, add *b* slowly and with constant stirring. As it cools, the mass will slowly set to a paste. Before it is too stiff for flowing pour into suitable containers and set aside until cold.

Formula No. 26[110]

Carnauba Wax	12.0
Rosin	0.5
Triethanolamine Oleate	3.5
Sodium Nitrate	0.1
Water	To make 100.0

Formula No. 27[111]

a.	Montan Wax, Crude	10
	Beeswax	4
	Carnauba Wax	1
	Japan Wax	5
	Shellac Wax	1¼
b.	Potassium Carbonate	1.5
	Boiling Water	75.0
	Borax	0.5
	Diglycol Stearate	1.0
	Palm Oil Soap	1.5
c.	Water	50
	Nigrosin	5
d.	Water	150

Formula No. 28[112]

Montan Wax, Crude	4.00
Japan Wax	0.30
Paraffin Wax (50/52°C.)	1.00
Carnauba Wax Residue	2.00
Carnauba Wax	0.50
Rosin	0.70

Beeswax	0.30
Potassium Carbonate	1.15
Water	30.00
Turpentine	10.00

Formula No. 29[113]

Montan Wax, Crude	10.00
Montan Wax, Double Bleached	3.00
Rosin	2.00
Paraffin Wax (50/52°C.)	2.00
Potassium Carbonate	2.20
Soap, Castile	0.30
Sodium Tetraborate	0.30
Nigrosin, Water-soluble	2.00
Metanil Yellow Dye	0.08
Water	95.00

Pour at 65°C.

Formula No. 30[114]

Montan Wax, Crude	15
Paraffin Wax (40/42°C.)	20
Rosin	5
Potassium Carbonate	3
Water	96
Metanil Yellow	0.9
Yellow Mandarin Dye, Water-soluble	0.8

Pour at 40–45°C.

Formula No. 31[115]

Montan Wax, Crude		15
Paraffin Wax, Soft		20
Rosin		4–6
Potassium Carbonate		3
Water		95
Oil-soluble Color	Mandarin Yellow	1
	Metanil Yellow	1

Formula No. 32[116]

a.	Crude Montan Wax	20.0
	Rosin	5.0

	Paraffin Wax (50/52°C.)	10.0
b.	Potassium Carbonate	6.0
	Water	60.0
c.	Nigrosin T.	5.5
	Water	50.0
d.	Water	50.0

Formula No. 33[117]

Montan Wax, Bleached	10
Montan Wax, Crude	5
Color L34	6
Candelilla Wax	4
Carnauba Wax	2
Paraffin Wax	5
Diglycol Stearate	3
Soap (Powdered)	2
Water	50
Turpentine	70

Melt the waxes, color and diglycol stearate together. Dissolve the soap in the water which must be boiling and add slowly with stirring to the melted waxes. When the temperature has fallen to 80°C. add the turpentine slowly with thorough agitation. Pour at 55°C.

For colors, use oil-soluble colors dissolved in the waxes.

Formula No. 34[118]

Trihydroxyethylamine Stearate	25
Beeswax	10
Candelilla Wax	30
Carnauba Wax	40
Turpentine	20
Water	500

Formula No. 35[119]

Shoe Stain:

a.	Montan Wax, Crude	15.0
	Rosin	2.0
	Paraffin Wax (40/42°C.)	3.0
	Potassium Carbonate	0.5

	Soap, Castile	4.0
	Water	65.0
b.	Shellac	20.0
	Sodium Tetraborate	7.0
	Water	75.0
c.	Nigrosine, Water-soluble	5.5
	Water	25.0

Prepare *a, b, c* separately and then mix together.

Formula No. 36[120]

a.	Vandyke Brown	8	lb.
	Raw Umber	30	lb.
	Casein Solution	4½	gal.
	Water	1¼	gal.
	Tragacanth Solution	½	gal.
b.	Water	7	gal.
	Caustic Soda	¾	lb.
	Castile Soap	2	lb.
	Gray Carnauba Wax	6	lb.
	Black Montan Wax	3	lb.
	Nigrosin	6	oz.
	Rogers Fish Glue	1½	gal.

Mix solutions of *a* and *b*.

Formula No. 37[121]

a.	Burnt Turkey Umber	20	lb.
	Indian Red	3	lb.
	Middle Chrome	2	lb.
	Casein Solution	1½	gal.
	Garnet Shellac Solution	1¾	gal.
b.	Water	6¾	gal.
	Castile Soap	1	lb.
	Gray Carnauba Wax	5¼	lb.
	Water Brown Dyestuff	1½	oz.

These two finishes are made in sections as above, the pigment paste being added to the wax solution either hot or cold. Usually no dyestuff is necessary, but for these darker shades, a trace of nigrosine or dark brown color is advisable. Both finishes are full bodied and will stand considerable dilution with either cold water or casein solution.

Formula No. 38[122]

Water	1	gal.
Nigrosine	3	oz.
Ethanolamine	¼	lb.
Stearic Acid	¾	lb.
Carnauba Wax	2½	lb.
Nigrosin Stearate	¼	lb.
Turpentine	¾	gal.
Clove Oil	1	oz.

The wax is melted in one container and diluted with the solvents and then vigorously stirred into the second receptacle with the boiling soap and alkaline solution.

Formula No. 39[123]

a.	Crude Montan Wax	18
	Japan Wax	2
	Carnauba Wax	4
	Rosin	2
b.	Water	260
	Potash (98%)	6
	Water-soluble Nigrosine	12

Heat *a* and *b* separately to 95–100°C. and add *b* to *a,* while stirring vigorously with an electric mixer.

Black Bottom Gloss[124]

Water	1	gal.
Potassium Oleate	6	oz.
Nigrosin	¾	lb.
Paraffin Wax	2	lb.
Black Montan Wax	3½	lb.
Japan Wax	2	lb.
Turpentine	½	gal.
White Spirit	½	gal.
Cassia Oil	5	oz.

These brown and black glosses are prepared in the same way as the white gloss, the waxes and solvents being mixed separately and added to the tinted boiling water.

Brown Bottom Gloss [125]

Water	1	gal.
Castile Soap	3½	oz.
Potassium Carbonate	1½	oz.
White Montan Wax	3	lb.
Yellow Beeswax	3	lb.
Turpentine	2	gal.
Terpineol	½	pt.
No. 62995 Water Brown Dyestuff	1½	oz.

"Natural" Bottom Finish [126]

a.	Titanox or Lithopone	14	lb.
	China Clay	13	lb.
	Yellow Ochre	10	lb.
	Casein Solution	4	gal.
	Bleached Shellac Solution	2	gal.
b.	Water	16	gal.
	Soap	3½	lb.
	Gum Arabic	6	lb.
	Yellow Carnauba Wax	10¾	lb.
	Fish Glue	7	pt.

Pale Pink Bottom Finish [127]

a.	Pale Buff (No. 8102 Pigment)	6	lb.
	Bleached Shellac Solution	1	gal.
	Water	3	pt.
b.	Water	1½	gal.
	Gum Tragacanth	1	qt.
	Potassium Oleate	¼	lb.
	Yellow Carnauba Wax	1¾	lb.
	Fish Glue	3	pt.

Shoe Ink [128]

Water	12	gal.
Logwood Extract	1¼	gal.
Gum Arabic	¾	lb.
Soft Soap	1¼	lb.
Carnauba Wax	6	lb.
Beeswax	2	lb.
Ferrous Sulfate	1¼	lb.

Modern Transparent Heel and Edge Finish [129]

Water	1½	gal.
Borax	1	oz.
T.N. Shellac	4	oz.
Brown Water Dyestuff	6½	oz.
Gum Tragacanth	¾	oz.
Castile Soap	3	oz.
Gray Carnauba Wax	¾	lb.

The ingredients are boiled together until solution is complete and, to prevent any separation of the wax, the whole is cooled down as quickly as possible with constant stirring.

Dark Brown Heel and Edge Stain [130]

a.	Water	1¼	gal.
	Borax	½	oz.
	Ammonia (Sp. Gr. 0.880)	½	oz.
	Dark Brown Dyestuff	12	oz.
	Lactic Casein	¾	lb.
b.	Water	1¼	gal.
	Sodium Stearate	5	oz.
	Algin	2½	oz.
	Shellac Wax	1½	lb.
	Nigrosine	1	oz.

Solution *a* is prepared and allowed to become quite cold. Solution *b* is boiled until all the wax has emulsified, and the cold dark brown dye solution is stirred into it rapidly. This prevents the separation of any wax when the finish is cold.

"Natural Leather" Bottom Stain[181]

a.	Gum Tragacanth (Powdered)	2	oz.
	Methylated Spirits	4	oz.
	Water	1	gal.
b.	Garnet Shellac	2	lb.
	Borax	½	lb.
	Water	1	gal.
c.	Castile Soap	3½	oz.
	Yellow Carnauba Wax	17	oz.
	Water	1	gal.
	Primrose Yellow Dyestuff	½	oz.

Prepare the three solutions *a, b, c* and allow the first two to become cold.

When solution *c* is boiling rapidly stir in 1 qt. each of the tragacanth and shellac solutions, and cool the whole off rapidly.

Brown Bottom Finish[182]

a.	Raw Umber	35	lb.
	Chrome Yellow	5	lb.
	Garnet Shellac Solution	4	gal.
	Water	2	gal.
b.	Soft Water	10	gal.
	Tragacanth Solution	1	gal.
	Sodium Stearate	1¼	lb.
	Gray Carnauba Wax	7¼	lb.
	Liquid Fish Glue	¾	gal.

Light Brown Russet Finish[183]

a.	Turkey Umber	10	lb.
	Kaolin	4	lb.
	Chrome Yellow	2	lb.
	Bleached Shellac Solution	1½	gal.
	Casein Solution	1	gal.
	Water	½	gal.
b.	Water	3	gal.
	Ammonium Linoleate	¾	lb.
	Gray Carnauba Wax	2¾	lb.

"Bend" Colored Bottom Finish[134]

a.	Yellow Ochre	6	lb.
	Lemon Chrome	3	lb.
	Titanox or Kaolin	16	lb.
	Water	2	gal.
b.	Water	7	gal.
	Shellac Solution	2½	gal.
	Castile Soap	1½	lb.
	Carnauba Wax	6¼	lb.
	Fish Glue	5½	pt.

Wax Russet Finish (Buff)[135]

a.	Soft Water	8	gal.
	Castile Soap	3	lb.
	Fish Glue	10	lb.
	Yellow Carnauba Wax	6	lb.
	Japan Wax	2	lb.
b.	Soft Water	5	gal.
	China Clay	40	lb.
	Yellow Ochre	10	lb.
	Red Oxide	3	lb.
	Citronella Oil	1½	lb.

Brown Russet Stain[136]

Soft Water	3¼	gal.
Farina	5	oz.
Castile Soap	½	lb.
Fish Glue	3½	pt.
Yellow Carnauba Wax	1¼	lb.
Borax	½	lb.
Orange Shellac	2	lb.
Burnt Turkey Umber	15	lb.
Boiled Linseed Oil	2½	pt.
Sassafras Oil	½	pt.

This finish is prepared in two parts, the water being divided up as above. The wax emulsion added to the color paste and the whole is then passed once or twice through a paint grinding mill.

"Natural Leather" Finish[187]

Soft Water	7	gal.
Irish Moss	¼	lb.
Castile Soap	½	lb.
Yellow Carnauba Wax	2¼	lb.
Borax	½	lb.
T.N. Shellac	2	lb.
Fish Glue	3	qt.
China Clay	34	lb.
Flake White	8	lb.
Middle Chrome	3½	lb.
Citronella Oil	1½	pt.

The wax and glue solution is prepared by boiling all the ingredients together, and then cooling down as quickly as possible so that there is no separation of the waxes. The earth pigments are ground up into a stiff paste with the water and the citronella oil, and the wax emulsion added to it: the whole is then passed through a paint mill.

White Bottom Gloss[138]

Water	1	gal.
Trihydroxyethylamine Stearate	2	lb.
Carnauba Wax	8	lb.
Stearic Acid	¼	lb.
Turpentine	1½	gal.

The wax, stearic acid and turpentine are melted and mixed together and then rapidly stirred into the boiling water and trihydroxyethylamine stearate.

White Bottom Cream[139]

Water	3	gal.
Potassium Stearate	¾	lb.
Beeswax	6	lb.
Yellow Carnauba Wax	6	lb.
Dekalin	2½	gal.

Turpentine	2½ gal.
Clove Oil	5 oz.

Brown Bottom Cream[140]

Water	3 gal.
Pearl Ash	½ lb.
Potassium Stearate	¼ lb.
White Beeswax	9 lb.
Yellow Carnauba Wax	3 lb.
Turpentine	5 gal.
Lavender Oil	½ lb.
Wax Brown Dyestuff	½ oz.
Orange II.	⅛ oz.

One Setting Edge Ink

Formula No. 1[141]

a.	Soft Water	5 gal.
	Ammonium Linoleate	1¾ lb.
	Gray Carnauba Wax	8 lb.
	Japan Wax	2 lb.
b.	Soft Water	10 gal.
	Borax	1¼ lb.
	Bleached Hank Lac	5 lb.
	Nigrosine	16 lb.
c.	Casein Solution (1¼ lb. per gal.)	
	Ammonia	½ pt.

The shellac-nigrosine solution is prepared by boiling and is allowed to become quite cold. The wax emulsion is boiled for half-an-hour and the dye solution added rapidly with vigorous stirring; the casein is then poured in slowly and the agitation continued until the ink is quite cold.

Formula No. 2[142]

Water	5 gal.
Borax	5 oz.
Bleached Shellac	1¼ lb.
Caustic Soda	½ lb.
Black Montan Wax	2¾ lb.

Carnauba Wax	¾	lb.
Nigrosine	4¾	lb.
Metanil Yellow	4	oz.
Ammonia	5	oz.

Formula No. 3[143]

Water	12¾	gal.
Borax	1	lb.
Bleached Shellac	4½	lb.
Caustic Soda	2½	lb.
Castile Soap	1¼	lb.
Gray Carnauba Wax	15½	lb.
Tragacanth Solution	6¼	gal.
Metanil Yellow	¼	lb.
Nigrosine	18	lb.

Boil the ingredients together in the order indicated, and cool down rapidly with continuous agitation. When cold add

Aniseed Oil, dissolved in	1¼	oz.
Methylated Spirits	½	gal.

Combined Ink for Bottoms, Heels and Edges[144]

Soft Water	35	gal.
Irish Moss	2½	oz.
Borax	2	lb.
Garnet Shellac	8	lb.
Castile Soap	3	lb.
Caustic Soda	3	lb.
Gray Carnauba Wax	16	lb.
Fibre Wax	8½	lb.
Nigrosine	42	lb.

The water is brought to boiling and the ingredients are added in the order indicated. (Care must be taken with the caustic soda, to add only small amounts at a time.) When the whole is completely in solution, the heat is taken away and the ink cooled down quickly by running cold water through the jacketed pan, mechanical stirring being maintained the whole time.

General Ink[145]

Soft Water	35	gal.
Irish Moss	5½	oz.
Borax	1½	lb.
Garnet Shellac	6	lb.
Castile Soap	3½	lb.
Caustic Soda	2¾	lb.
Black Montan Wax	12	lb.
Gray Carnauba Wax	4	lb.
Fiber Wax	8	lb.
Nigrosine	38	lb.
Metanil Yellow	2	lb.

Polishing Ink[146]

a.	Water	80.0
	Marseilles Soap	3.0
	Carnauba Wax	4.0
	Japan Wax	2.0
b.	Water	20.0
	Methyl Cellulose	1.0
c.	Turpentine Oil	1.0
	Citronella Oil	0.3

Boil the mixture *a*, when cooled, add the dispersion *b* which has been boiled separately. When cooled, add *c*.

Quick Black

Formula No. 1[147]

Soft Water	8	gal.
Castile Soap	1½	lb.
Gray Carnauba Wax	6½	lb.
Caustic Potash	½	lb.
Nigrosine	8	lb.

Formula No. 2[148]

Water	10	gal.
Tragacanth Solution	4	gal.

Caustic Soda	2½	lb.
Castile Soap	1	lb.
Gray Carnauba Wax	11¾	lb.
Nigrosine	15½	lb.
Metanil Yellow Dyestuff	6	oz.
Ammonia (Added When Cold)	8	oz.

Prepare 4 gal. of tragacanth solution by dissolving ½ lb. of the powdered gum in 4 gal. water.

Formula No. 3 [149]

Soft Water	12½	gal.
Ammonium Linoleate	1½	lb.
Yellow Carnauba Wax	10¼	lb.
Nigrosine	12	lb.
Ammonia	3	oz.

Formula No. 4 [150]

a.	Water	3	gal.
	Metanil Yellow	¼	lb.
	Nigrosine	8½	lb.
	Casein Solution	2	gal.
b.	Water	4	gal.
	Castile Soap	1¼	lb.
	Gray Carnauba Wax	7	lb.

Prepare a casein solution by dissolving 2½ lb. casein in 2 gal. of hot water with the aid of 3½ oz. ammonia (sp. gr. 0.880).

The nigrosine-casein mixture is prepared separately and allowed to become quite cold. The wax is boiled until in solution and the cold dye added quickly to cool it down. Stirring is continued until the mixture is quite cold.

Formula No. 5 [151]

a.	Water	6	gal.
	Borax	1¼	lb.
	Garnet Shellac	5	lb.
	Metanil Yellow	6	oz.
	Nigrosine	14	lb.

b.	Water	4½	gal.
	Tragacanth Solution	1	gal.
	Castile Soap	1¾	lb.
	Gray Carnauba Wax	12	lb.
	Ammonia (Added Cold)	4	oz.

This ink is prepared with two solutions, the cold dye being added to the boiling wax to cool it down.

Formula No. 6[152]

a.	Soft Water	25	gal.
	Borax	2	lb.
	Garnet Shellac	8	lb.
	Nigrosine	40	lb.
	Metanil Yellow	2	lb.
b.	Soft Water	10	gal.
	Ethanolamine	2	lb.
	Stearic Acid	6	lb.
	Yellow Carnauba Wax	30	lb.
	Black Montan Wax	2	lb.

Heavy Ink for Spongy Leathers[153]

a.	Water	4	gal.
	Metanil Yellow	5	oz.
	Nigrosine	11¼	lb.
	Casein Solution (2½ Lb. to 2 Gal.)	1½	gal.
b.	Water	4	gal.
	Tragacanth Solution	1	gal.
	Castile Soap	2	lb.
	Gray Carnauba Wax	10½	lb.

The two solutions are prepared separately and the cold dye solution added to the emulsified wax.

Burnishing Ink[154]

Paraffin Wax	3.0
Carnauba Wax	3.0
Japan Wax	6.0
Rosin	6.0

Nigrosine, Water-soluble	2.4
Soda Ash, Calcined	3.0
Water	76.6

Gloss Ink [155]

a.	Montan Wax, Crude	15
	Colophony	2
	Soft Paraffin 40/42°C.	3
	Potash Carbonate	½
	Marseilles Soap	4
	Water	65
b.	Shellac	20
	Borax	7
	Water	75
c.	Nigrosine NTL	5½
	Water	25

Make up separately *a*, *b*, and *c*, and mix these three components together.

White Shoe Polishes

Formula No. 1 [156]

Titanium Dioxide (Water-dispersing grade)	15.0
Pine Oil	1.0
Sodium Alginate	0.3
Gum Arabic	1.0
Carnauba Wax	1.0
Japan Wax	1.0
Oleic Acid	0.5
Triethanolamine	0.5
Water	79.7
Preservative	Sufficient

The pine oil is emulsified with a small portion of the oleic acid and triethanolamine. The pigment is wetted thoroughly with this emulsion. The sodium alginate is dissolved in a small part of the water and added to the pigment mix. The gum arabic is dissolved by heating to about 180°F. (on a water bath), with a small amount of water. When the gum arabic is completely dissolved, it is cooled to room temperature and added to the pigment mix. The waxes are heated with the remaining amounts of oleic acid and triethanolamine to the melting point (about 185°F.) of the carnauba wax and then a sufficient amount of water (boiling hot) is added while stirring vigorously. Stirring should be continued for about ten minutes or until a smooth emulsion is formed. This emulsion is cooled to room temperature with slight agitation.

Formula No. 2[157]
(White Gloss)

Yellow Carnauba Wax	3½ lb.
Beeswax	1¼ lb.
Japan Wax	1 lb.
Ceresin Wax	½ lb.
Turpentine	½ gal.
White Spirit	½ gal.
Ethanolamine	¾ lb.
Stearic Acid	1½ lb.
Water	1 gal.

The waxes, stearic acid and the ethanolamine are melted together in a steam jacketed pan and the mixture of turpentine and white spirit added slowly so that there is no precipitation of the waxes. The water is boiled and stirred into the other melted components.

Formula No. 3[158]
(White Gloss)

Soft Water	½ gal.
Castile Soap	¾ lb.
Yellow Carnauba Wax	3 lb.
Turpentine	½ gal.
Raw Linseed Oil or Mineral Oil	½ pt.

The water and soap are boiled together until a clear solution is obtained; the wax is melted in a second pan and the turpentine and oil added to it. The wax solution is then rapidly transferred to the boiling water with constant stirring. The whole rapidly thickens to a creamy paste, which when cold is packed. To obtain a smooth lustrous appearance the tin is then passed under a flat hot plate.

Formula No. 4[159]
(White Kid Cleaner)

a.	Carnauba Wax, Gray	50 g.
	Montan Wax, Bleached	50 g.
	Paraffin Wax (50/52°C.)	20 g.
	Japan Wax	20 g.
	Rosin	15 g.
	Diglycol Stearate	10 g.
	Potassium Carbonate	32 g.
	Water	600 g.
b.	Turpentine	150 cc.
	Benzene	100 cc.
	Trichlorethylene	150 cc.
	Acetone	50 cc.

Boil *a* together with stirring, until a homogeneous emulsion has been formed. Cool to 40°C., and add the solvents *b*. Stir until cooled.

Formula No. 5[160]
(White Shoe Cleaner)

Titanium Dioxide	5
Lithopone	15
Dammar	4
Carbon Tetrachloride	10
Petroleum Naphtha	13
Triethanolamine Stearate	2
Water	51

Dammar resin is dissolved in the petroleum naphtha and the solution is strained to remove undissolved matter. The triethanolamine stearate is dissolved in warm water. After cooling, the resin solution is stirred into the water solution, using vigorous agitation; additions must be slow. When the emulsion is smooth, the carbon tetrachloride is stirred in followed by the pigments.

Metal Polishes

Formula No. 1[161]

Two parts of fatty acids from tallow or from hardened fat, 8 parts of tall oil, 5 of petroleum and 5 of denatured alcohol are treated with 5 parts of ammonia, sp. gr. 0.91, for saponification of the fatty acids. To this are added 45 parts of water and then a mixture of 5 parts of bentonite and 25 parts of amorphous silica. This product is rather viscous and settles out only slowly.

Formula No. 2[162]

Gum Tragacanth	0.20
Water	63.15
Wetanol	0.50
Glycerin	5.65
Diatomaceous Earth	12.25
Neutral Oil (Mineral)	17.00
Amyl Acetate	0.25
Formaldehyde	1.00

Formula No. 3[163]

Kieselguhr	5.0
Silica Dust	4.0
Ferric Oxide	4.0
Naphtha	19.0
Kerosene	10.0
Red Oil	2.0
Triethanolamine	0.5
Ammonia (26° Bé.)	1.5
Water	54.0

The oleic acid is first mixed with the kerosene and naphtha, the abrasives then being stirred in. Stirring is continued while the ammonia and triethanolamine solution are added. If desired, the proportion of water may be increased by about another 10%.

Formula No. 4[164]

Naphtha	62
Oleic Acid	1
Abrasive	7
Triethanolamine	⅓
Ammonia (26°)	1
Water	128

Formula No. 5[165]

a.	Oleic Acid or Tall Oil	20
	Benzine	14
	Methylhexalin	2
b.	Alcohol	16
	Ammonia (Sp. Gr. 0.960)	13
c.	Kieselguhr, Finest	35

Add the mixture *b* to the solution *a*, with agitation. Work in *c*. Let stand overnight. Strain.

Formula No. 6[166]

a.	Naphtha	60
	Oleic Acid	5
b.	Triethanolamine	2
	Water	125
c.	Naphtha	5
d.	Ammonia	2–3
e.	Clay	1
	Tripoli	11
	Aluminum Oxide	77

To the solution *a* add with good agitation the solution *b*. When emulsified, add *c*, *d*, and finally the mixture *e* to get a paste.

Formula No. 7[167]

a.	Soft Soap	30
b.	Turpentine	10
c.	Alcohol	5
d.	Water	10
e.	Kieselguhr	20

	Emery	20
	Chrome Oxide	5

Thin *a* with *b, c, d* in the given order; work in *e*.

Formula No. 8[168]

a.	Oleic Acid or Tall Oil	5
	Turpentine	15
b.	Ammonia	3
c.	Water	30
d.	Whiting	10
	Emery	20
	Glass, Powdered	10
	Graphite Dust	7

To the solution *a* add *b* with good agitation. Thin with *c*. Work in *d* to get a paste.

Formula No. 9[169]

Water	480.0
Suspendite	15.0
Ammonium Laurate S	40.0
Silica	180.0
Solvent Naphtha	13.6
Ammonia (26°)	22.4

The Suspendite is added to warm water with stirring until smooth. The ammonium laurate S is added, with stirring, and then the silica. Under rapid agitation this should take about 10–15 minutes. The naphtha is added, with continued stirring, and finally the ammonia.

The consistency of the polish can be varied by varying the amounts of the different ingredients.

Formula No. 10[170]

Ammonium Linoleate R	20
Oxalic Acid	2
Ammonia	4
Water	150
Naphtha V. M. & P.	10

Silica	60
Alcohol	5

Heat the water to 70°C. Dissolve the oxalic acid, add the silica and stir until dispersed. Add the ammonia and stir for a few minutes keeping at 70°C. Then add the ammonium linoleate R and stir until dissolved. Add the naphtha slowly and stir. The mixture becomes very heavy. The alcohol is then added slowly until the desired body and viscosity are obtained.

Formula No. 11[171]

Ammonium Linoleate R	20
Naphtha V. M. & P.	100
Silica	40
Alcohol	2
Ammonia	2

Heat the naphtha cautiously to 60°C. Dissolve the ammonium linoleate R and disperse the silica. Add the ammonia when the mixture becomes very heavy. It is then thinned down as desired by the addition of the alcohol.

Formula No. 12[172]

a.	Ammonium Linoleate	9
	Turpentine	20
b.	Alcohol	4
	Water	22
c.	Whiting	40
	Chrome Oxide	5

Mix *a*, which has been previously heated to about 50°C., with *b*, adding the latter with good agitation; work in *c*.

Formula No. 13[173]

a.	Soft Soap	20
	Turpentine	15
	Alcohol	5
b.	Water	15
c.	Whiting	35
	Yellow Ochre	10

Make solution *a,* add *b,* and when homogeneous, use to make a paste with *c.*

Formula No. 14 [174]

Tripoli	1¼ lb.
Pine Oil (Steam-distilled)	1½ pt.
Oleic Acid	7 fl. oz.
Sodium Hydroxide (Sticks)	½ oz.
Water	3 pt.

Mix the pine oil and oleic acid. Dissolve the sodium hydroxide in the water and run this mixture into the oil while mixing. Mixing should be continued for about 5 minutes. The tripoli is finally added and thoroughly mixed in.

This metal polish is applied with a soft cloth.

Formula No. 15 [175]

Stearic Acid	10
Naphtha	30
Caustic Potash (30° Bé.)	5
Alcohol	6
Mixture of Clay, Tripoli 1:4	Sufficient to make a paste

To the naphtha-stearic acid solution add the alkali, then the alcohol. Work into a paste with the minerals.

Formula No. 16 [176]

Potassium Hydroxide	40 g.
Water	900 cc.
Olive Olein	150 cc.
Alcohol	25 cc.
Ethylene Dichloride	50 cc.

Add the potassium hydroxide to the water, warm to 75°C. and slowly stir in the olive olein until completely dissolved. Cool and add the alcohol and ethylene dichloride.

Formula No. 17[177]

a.	Ortho Dichlorbenzol	5
	Naphtha or Mineral Spirits	20
	Pine Oil	4
b.	Trihydroxyethylamine Linoleate	2
	Tripoli or Silex	50–75
	Suspendite	9
	Water	260
c.	Ammonium Hydroxide	12

Add *a* to *b* with stirring and then stir in *c;* allow to stand overnight and stir before packaging.

This gives a polish which does not separate if made properly. If a thicker polish or paste is desired the Tripoli is increased and the liquids decreased.

Formula No. 18[178]

Dissolve 5 parts curd soap in 40 parts water, adding 20 parts of a 5% methyl cellulose slime. Then add 15 parts kieselguhr, 10 parts tripoli, and 10 parts denatured alcohol.

Formula No. 19[179]

Tripoli	20.0
Oleic Acid	7.0
Sodium Hydroxide (100%)	0.5
Yarmor	25.0
Water	47.5

Formula No. 20[180]

a.	Ammonium Linoleate	6
	Benzine	16
b.	Water	28
c.	Calcium Carbonate	40
	Pigment (e.g., Ultramarine)	10

Make emulsion by adding *b* to *a* with stirring. Work into this the fine powder *c*.

Formula No. 21[181]

a.	Ammonium Linoleate	9
	Turpentine Substitute	16
	Alcohol	2
b.	Emery	20
	Whiting	25
	Glass Powder	10
c.	Water	18

Mix *a,* and wet *b* thoroughly in this oil-solvent mixture. Add *c* to the whole with thorough agitation and in small portions.

Formula No. 22[182]

a.	Ammonium Linoleate	25
	Water	40
b.	Whiting	15
	Quartz Flour	10
	Chromium Oxide	10

Formula No. 23[183]

a.	Soft Soap	15
	Methyl Cyclohexanol	2
b.	Turpentine	15
c.	Ammonia (Sp. Gr. 0.910)	5
	Water	23
d.	Green Earth	10
	Whiting	10
	Pumice Meal	10
	Emery	10

Stir together *a* and *b*, add *c* with good agitation. Now add the powders *d*, mixing very thoroughly.

Formula No. 24[184]

a.	Oleic Acid	15
	Mineral Oil, White	10
	Alcohol	45
b.	Ammonia (Sp. Gr. 0.910)	5
c.	Chrome Oxide	25

Emulsify, adding *b* to *a* with stirring. Work in *c* with thorough agitation.

Formula No. 25[185]

a.	Diglycol Stearate	6
	Water	66
b.	Oleic Acid	5
c.	Kieselguhr	14
	Iron Oxide Red	6
d.	Ammonia (Sp. Gr. 0.910)	3

Mix *b* with the hot solution *a*. Work in the abrasives *c*, and saponify with *d*. Mix thoroughly, and allow to stand overnight. Strain.

Formula No. 26[186]

a.	Diglycol Laurate	8
	Water	50
b.	Oleic Acid or Tall Oil	4
c.	Kieselguhr, Calcined	20
	Lime Green	4
d.	Ammonia (Sp. Gr. 0.910)	4
e.	Alcohol	10

Mix *b* with *a*, work in *c* with good agitation; saponify with *d*. Let stand overnight. Keep covered. Add *e*. Strain 6 hours later.

Protective Coating for Aluminum and Other Metals[187]

Paraffin Wax	4
Diglycol Stearate	1
Flexo Wax C (Amorphous Petroleum Wax)	2
Water	40

Heat together and mix with high-speed agitator until uniform emulsion is formed.

Apply by spraying or brushing.

Stove Polishes

Formula No. 1[188]

Cumarone Resin	2
Paraffin Wax, Soft	2
Montan Wax, Crude	5–6
Potash Carbonate	4
Water	200
Nigrosine Base BB	10
Lampblack	24
Graphite	56

Formula No. 2[189]

Crude Montan Wax	2
Rosin	1
Carnauba Wax	2

Heat to 90°C. with stirring and to it add slowly

Caustic Potash	2
Water (Boiling)	86
Nigrosine	3

Keep on heat and agitate vigorously until uniform. Cool and work in

Graphite Flake	5
Lampblack	3

Mix thoroughly until uniform.

Formula No. 3[190]

Paraffin Wax (40/42°C.)	3.5
Ozokerite, Crude	2.0
Turpentine	40.0
Rosin (D to K Grades)	0.7
Lampblack	4.0
Graphite	24.0
Ammonium Linoleate	4.0
Water	20.0
Nigrosine, Oil-soluble	0.8
Potassium Carbonate	1.0

Formula No. 4 [191]

Rosin Oil	2
Montan Wax (Black)	2
Carnauba Wax	2
Water	82
Caustic Potash	2
Nigrosine	3
Graphite	5
Lampblack	3

The oil and waxes are carefully melted. The potash and nigrosine are dissolved in the water and gradually stirred into the wax mixture at 85–90°C. The resultant product is agitated thoroughly during the cooling, when the graphite and lampblack are uniformly incorporated. The caustic potash forms a soap with the resin and aids emulsification and retards settling of the black.

Formula No. 5 [192]

Stearic Acid	10
Spindle Oil	20
Triethanolamine Linoleate	27
Water	13
Spindle Oil	20
Tetralin	10
Abrasive (Emery, Tripoli, Silicaceous Earth, etc.)	Sufficient to make a paste

Dissolve the fatty acids in the first spindle oil, mix with triethanolamine linoleate; add the second spindle oil, the Tetralin, and ultimately the abrasive.

Formula No. 6 [193]

a.	Graphite	24
	Glycerin, Crude	5
	Formaldehyde	1
b.	Hard Soap	3.2
	Water	26
	Paraffin	4

Prepare the solution *b* by boiling, and add to it the paste *a*. Stir till cold, and pour.

Formula No. 7[194]

a.	Carnauba Wax	6
	Montan Wax, Bleached	3
	Beeswax	3
	Rosin	1
	Diglycol Stearate	1
	Potash Carbonate	1
	Water	45
b.	Turpentine	40

Boil *a* until a homogeneous mass is formed. Thin with *b*.

Formula No. 8[195]

a.	Montan Wax, Crude	2.5
	Rosin	0.8
	Japan Wax	0.7
b.	Nigrosine, Oil-soluble	0.6
c.	Potassium Carbonate	1.5
	Water	53.9
d.	Graphite	28.0
	Soot	12.0

Melt *a*. Dissolve *b* in the melted *a*. Boil *c*, and stir in *d* to get a smooth suspension. Mix *c* + *d* into *a* + *b*, with good stirring. Put into cans while hot.

Formula No. 9[196]

a.	Crude Montan Wax	2
	Carnauba Wax	2
	Rosin	1
	Potash Carbonate	2
	Water	72
b.	Nigrosine, Water-soluble	1
	Graphite	20

Boil *a* until homogeneous. Stir in *b* gradually, until smooth.

Miscellaneous Polishing Emulsions

Formula No. 1[197]
(Type "Sidol")

Oleic Acid, Distilled	20
Alcohol	15
Heavy Benzine	15
Ammonia (Sp. Gr. 0.91)	12
Neuburg Chalk	18
Kieselguhr	12
White Bolus	8

The oleic acid, dissolved in the solvent mixture, is saponified on the water-bath at a temperature below the boiling point of the alcohol, 60–70°C. The liquid is now thickened with the abrasives which are added with good agitation.

Formula No. 2[198]

a.	Neuburg Chalk	80.0
	Kieselguhr	4.0
	Water	300.0
b.	Oleic Acid	3.5
	Ammonia (Sp. Gr. 0.91)	1.0
	Alcohol	6.5
	Naphtha	10.0

To the mixture *a,* made 24 hours earlier and left overnight, add *b.*

Formula No. 3[199]

Water	110
Oxalic Acid	16
Oleic Acid	25
Stearic Acid	4
Alcohol	15
Turpentine	7½
Neuburg Chalk	125
Water	215
Ammonia (Sp. Gr. 0.91)	27½

Dissolve the oxalic acid in one-third of the necessary water by heating to about 60°C., and add the remainder of the water.

Melt the fatty acids, turn out any flames, and add the solvents with stirring.

Add the oils to the water, with stirring, and add the chalk; saponify with the ammonia, until, after an initial thickening, the mass starts to become thin again.

Keep in kettle for 2 days, stirring intermittently. If the mass still settles, add more oleic acid.

Formula No. 4[200]

a.	Olein, Distilled	9
	Stearic Acid	2
	Alcohol	10
b.	Ammonia (Sp. Gr. 0.91)	14
c.	Oxalic Acid	2
	Water (50–60°C.)	70
d.	Neuburg Chalk, Fine	25

Dissolve *a* by heating to about 50–60°C. on water bath, saponify with *b*, and add the solution *c*. The resulting liquid is mixed with *d* in a mixer.

Formula No. 5[201]

Oleic Acid	16
Ammonia	10
Clay, Powdered	60
Alcohol	10
White Spirit	10
Oxalic Acid	3
Water	160

Formula No. 6[202]

Oleic Acid	18
White Spirit	150
Clay, Powdered	56
Ammonia	6
Alcohol	4

Formula No. 7 [203]

Spindle Oil	4
Oleic Acid	10
White Spirit	3
Ozokerite	4
Clay	15
Ammonia	½

Formula No. 8 [204]

a. Ammonium Oleate	2.1
Water	19.5
b. Stearic Acid	1.0
c. Ammonia (Sp. Gr. 0.91)	0.5
d. Alcohol	2.1
e. Neuburg Chalk	6.0

Heat *a* almost to boiling to dissolve; add *b* with good stirring, cool to 75°C., and saponify with *c*. Cool to 50°C., add *d*, and work in *e* with very thorough mixing.

Formula No. 9 [205]

Water	60
Bentonite	1
Naphthenic Soap	6
Silica or Tripoli	15
Mineral Oil	18

Formula No. 10 [206]

Gray Carnauba Wax	25
Japan Wax	5
Rosin	5

Melt and stir in

Turpentine Substitute	60

Strain and add

Solution of Potash (1%)	5

Formula No. 11[211]

a.	Ammonium Linoleate	8
	Water	60
b.	Water	5
	Potato Flour	2
c.	Graphite	20
	Lampblack	5

Make solution *a*, and separately paste *b*. Add *b* to *a*, mixing thoroughly. Work *c* slowly into this dispersion.

Formula No. 12[212]

Carnauba Wax	4989
Solvent Naphtha	7000
Stearic Acid	1360
Nigrosine, Oil-soluble	907
Diglycol Laurate	200
Triethanolamine	450
Water	29937
Nigrosine, Water-soluble	453

Dissolve the water-soluble nigrosine in the water, add the triethanolamine and, while hot, the stearic acid and diglycol laurate. Take up to a boil.

Add to this the solution of carnauba wax and the oil-soluble nigrosine in the naphtha, at 85–90°C. Stir until cold.

Polish Powder[213]

Kerosene	20 fl. oz.
Silica (300 Mesh)	2 oz.
Infusorial Earth	1 lb.
Mineral Oil, Light	10 fl. oz.
Sulfonated Castor Oil	4 fl. oz.

Mix the oils and powders separately and work the two components together. Four oz. of this mass are to be stirred into a quart of water for use. On standing, the water solution will settle out. Shaking will restore it to a usable state.

Fur Glaze[214]

Add 10 parts of ammonium linoleate to 500 parts of water and to this mixture is added 50 parts of melted carnauba wax.

Neatsfoot Oil Polish[215]

Neatsfoot Oil (20° Cold Test)	50
Lanolin Anhydrous	35
Japan Wax	20
Soap Chips	8
Water	90

Glass Polish[216]

a. Ammonium Linoleate	20
b. Orthodichlorbenzol	100
c. Water	200
d. Infusorial Earth	60

Dissolve *a* in *c* overnight and run *b* in while beating with high-speed mixer. Then beat *d* in until uniform.

Oil Polish[217]

Mineral Oil	60
Naphtha	26
Turpentine	3
Stearic Acid	9
Triethanolamine	4
Methanol	4
Water	120

Abrasive Polish[218]

a. Carnauba Wax	42 lb.
b. Beeswax	18 lb.
c. Ceresin	18 lb.
d. Varnolene	3 gal.
e. Water	3 gal.
f. Triethanolamine	8 oz.

g. Stearic Acid	2 lb.
h. Tripoli	24 lb.
i. Pumice	15 lb.

Melt *a, b, c, g* with *d.* Heat *e* and *f* to 90°C., add to wax mixture and stir till emulsified. Then add *h* and *i* and stir till cool.

REFERENCES

[1] Bennett, Chem. Formulary, Vol. 4, p. 403 (1939).
[2] Bennett, Chem. Formulary, Vol. 4, p. 437 (1939).
[3] Bennett, Chem. Formulary, Vol. 1, p. 418 (1933).
[4] Bennett, Chem. Formulary, Vol. 2, p. 421 (1935).
[5] Bennett, Chem. Formulary, Vol. 1, p. 430 (1933).
[6] Bennett, Chem. Formulary, Vol. 4, p. 405 (1939).
[7] Bennett, Chem. Formulary, Vol. 4, p. 405 (1939).
[8] Bennett, Chem. Formulary, Vol. 4, p. 403 (1939).
[9] Bennett, Chem. Formulary, Vol. 4, p. 404 (1939).
[10] Crowley, Money Making Formulas.
[11] Brown, U. S. 1,392,477 (1921).
[12] Bennett, Chem. Formulary, Vol. 4, p. 404 (1939).
[13] Bennett, Chem. Formulary, Vol. 1, p. 418 (1933).
[14] Tumbler, U. S. 1,969,387.
[15] Bennett, Chem. Formulary, Vol. 3, p. 286 (1936).
[16] Bennett, Chem. Formulary, Vol. 1, p. 418 (1933).
[17] Bennett, Chem. Formulary, Vol. 4, p. 404 (1939).
[18] Bennett, Chem. Formulary, Vol. 4, p. 405 (1939).
[19] Bennett, Chem. Formulary, Vol. 5, p. 534 (1941).
[20] Bennett, Chem. Formulary, Vol. 1, p. 418 (1933).
[21] Bennett, Chem. Formulary, Vol. 2, p. 421 (1935).
[22] Bennett, Chem. Formulary, Vol. 3, p. 285 (1936).
[23] Bennett, Chem. Formulary, Vol. 4, p. 404 (1939).
[24] Bennett, Chem. Formulary, Vol. 4, p. 405 (1939).
[25] Bennett, Chem. Formulary, Vol. 4, p. 403 (1939).
[26] Bennett, Chem. Formulary, Vol. 2, p. 421 (1935).
[27] Bennett, Chem. Formulary, Vol. 4, p. 403 (1939).
[28] Bennett, Chem. Formulary, Vol. 4, p. 403 (1939).
[29] Bennett, Chem. Formulary, Vol. 4, p. 403 (1939).
[30] Bennett, Chem. Formulary, Vol. 4, p. 405 (1939).
[31] Bennett, Chem. Formulary, Vol. 4, p. 405 (1939).
[32] Bennett, Chem. Formulary, Vol. 4, p. 405 (1939).
[33] Bennett, Chem. Formulary, Vol. 4, p. 405 (1939).
[34] Bennett, Chem. Formulary, Vol. 2, p. 421 (1935).
[35] Bennett, Chem. Formulary, Vol. 4, p. 405 (1939).
[36] Bennett, Chem. Formulary, Vol. 3, p. 285 (1936).
[37] Bennett, Chem. Formulary, Vol. 4, p. 405 (1939).
[38] Bennett, Chem. Formulary, Vol. 3, p. 285 (1936).

[39] Bennett, Chem. Formulary, Vol. 1, p. 418 (1933).

[40] Personal Communication.

[41] Bennett, Chem. Formulary, Vol. 4, p. 420 (1939).

[42] Bennett, Chem. Formulary, Vol. 5, p. 533 (1939).

[43] Bennett, Chem. Formulary, Vol. 5, p. 533 (1939).

[44] Bennett, Chem. Formulary, Vol. 1, p. 421 (1933).

[45] Bennett, Chem. Formulary, Vol. 4, p. 432 (1939).

[46] Personal Communication.

[47] Personal Communication.

[48] Personal Communication.

[49] Bennett, Chem. Formulary, Vol. 4, p. 419 (1939).

[50] Bennett, Chem. Formulary, Vol. 4, p. 419 (1939).

[51] Bennett, Chem. Formulary, Vol. 1, p. 420 (1933).

[52] Bennett, Chem. Formulary, Vol. 2, p. 423 (1935).

[53] Bennett, Chem. Formulary, Vol. 2, p. 423 (1935).

[54] E. I. du Pont de Nemours Co., Wilmington, Del.

[55] Bennett, Chem. Formulary, Vol. 4, p. 418 (1939).

[56] Bennett, Chem. Formulary, Vol. 4, p. 419 (1939)

[57] Bennett, Chem. Formulary, Vol. 5, p. 532 (1941).

[58] Personal Communication.

[59] Bennett, Chem. Formulary, Vol. 1, p. 421 (1933).

[60] Bennett, Chem. Formulary, Vol. 5, p. 532 (1941).

[61] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[62] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[63] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[64] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[65] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[66] Bennett, Chem. Formulary, Vol. 4, p. 432 (1939).

[67] Bennett, Chem. Formulary, Vol. 5, p. 534 (1941).

[68] Bennett, Chem. Formulary, Vol. 1, p. 422 (1933).

[69] Bennett, Chem. Formulary, Vol. 1, p. 422 (1933).

[70] Bennett, Chem. Formulary, Vol. 1, p. 422 (1933).

[71] Bennett, Chem. Formulary, Vol. 1, p. 423 (1933).

[72] Bennett, Chem. Formulary, Vol. 1, p. 423 (1933).

[73] Crowley, Money Making Formulas.

[74] Crowley, Money Making Formulas.

[75] Bennett, Chem. Formulary, Vol. 2, p. 421 (1935).

[76] Crowley, Money Making Formulas.

[77] Bennett, Chem. Formulary, Vol. 3, p. 287 (1936).

[78] Bennett, Chem. Formulary, Vol. 3, p. 287 (1936).

[79] Bennett, Chem. Formulary, Vol. 5, p. 534 (1941).

[80] Bennett, Chem. Formulary, Vol. 1, p. 422 (1933).

[81] Bennett, Chem. Formulary, Vol. 1, p. 422 (1933).

[82] Bennett, Chem. Formulary, Vol. 1, p. 423 (1933).

[83] Crowley, Money Making Formulas.

[84] Bennett, Chem. Formulary, Vol. 5, p. 533 (1941).

[85] Bennett, Chem. Formulary, Vol. 5, p. 534 (1941).

[86] Davidsohn and Davidsohn, Shoe Creams and Polishing Waxes.

[87] Davidsohn and Davidsohn, Shoe Creams and Polishing Waxes.

[88] Davidsohn and Davidsohn, Shoe Creams and Polishing Waxes,

[89] Bennett, Chem. Formulary, Vol. 1, p. 424 (1933).

[90] Bennett, Chem. Formulary, Vol. 2, p. 290 (1935).

[91] U. S. 2,275,596.

[92] Bennett, Chem. Formulary, Vol. 1, p. 430 (1933).

[93] Bennett, Chem. Formulary, Vol. 4, p. 430 (1939).

[94] Bennett, Chem. Formulary, Vol. 4, p. 431 (1939).

[95] Bennett, Chem. Formulary, Vol. 4, p. 430 (1939).

[96] Bennett, Chem. Formulary, Vol. 1, p. 429 (1933).

[97] Bennett, Chem. Formulary, Vol. 4, p. 430 (1939).

[98] Bennett, Chem. Formulary, Vol. 4, p. 430 (1939).

[99] Davidsohn and Davidsohn, Shoe Creams and Polishing Waxes.

[100] Davidsohn and Davidsohn, Shoe Creams and Polishing Waxes.

[101] Davidsohn and Davidsohn, Shoe Creams and Polishing Waxes.

[102] Davidsohn and Davidsohn, Shoe Creams and Polishing Waxes.

[103] Davidsohn and Davidsohn, Shoe Creams and Polishing Waxes.

[104] Davidsohn and Davidsohn, Shoe Creams and Polishing Waxes.

[105] John, White Shoe Dressings and Cleaners (1940).

[106] John, White Shoe Dressings and Cleaners (1940).

[107] John, White Shoe Dressings and Cleaners (1940).

[108] John, White Shoe Dressings and Cleaners (1940).

[109] Bennett, Chem. Formulary, Vol. 1, p. 430 (1933).

[110] Personal Communication.

[111] Bennett, Chem. Formulary, Vol. 4, p. 431 (1939).

[112] Bennett, Chem. Formulary, Vol. 4, p. 431 (1939).

[113] Bennett, Chem. Formulary, Vol. 4, p. 432 (1939).

[114] Bennett, Chem. Formulary, Vol. 4, p. 432 (1939).

[115] Bennett, Chem. Formulary, Vol. 5, p. 536 (1941).

[116] Bennett, Chem. Formulary, Vol. 4, p. 431 (1939).

[117] Bennett, Chem. Formulary, Vol. 4, p. 429 (1939).

[118] Bennett, Chem. Formulary, Vol. 1, p. 428 (1933).

[119] Bennett, Chem. Formulary, Vol. 4, p. 432 (1939).

[120] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[121] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[122] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[124] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[125] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[126] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[127] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[128] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[129] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[130] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[131] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[132] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[133] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[134] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[135] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[136] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[137] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[138] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[139] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.

[140] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.
[141] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.
[142] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.
[143] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.
[144] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.
[145] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.
[146] Bennett, Chem. Formulary, Vol. 4, p. 432 (1939).
[147] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.
[148] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.
[149] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.
[150] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.
[151] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.
[152] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.
[153] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.
[154] Bennett, Chem. Formulary, Vol. 4, p. 183 (1939).
[155] J. Davidsohn and A. Davidsohn, Shoe Creams and Polishing Waxes.
[156] John, White Shoe Dressings and Cleaners (1940).
[157] John, White Shoe Dressings and Cleaners (1940).
[158] John, White Shoe Dressings and Cleaners (1940).
[159] Bennett, Chem. Formulary, Vol. 4, p. 428 (1939).
[160] Bennett, Chem. Formulary, Vol. 5, p. 535 (1941).
[161] Bennett, Chem. Formulary, Vol. 5, p. 526 (1941).
[162] Personal Communication.
[163] Bennett, Chem. Formulary, Vol. 5, p. 526 (1941).
[164] Bennett, Chem. Formulary, Vol. 1, p. 426 (1933).
[165] Bennett, Chem. Formulary, Vol. 4, p. 412 (1939).
[166] Bennett, Chem. Formulary, Vol. 4, p. 437 (1939).
[167] Bennett, Chem. Formulary, Vol. 4, p. 409 (1939).
[168] Bennett, Chem. Formulary, Vol. 4, p. 409 (1939).
[169] Bennett, Chem. Formulary, Vol. 5, p. 526 (1941).
[170] Bennett, Chem. Formulary, Vol. 4, p. 408 (1939).
[171] Bennett, Chem. Formulary, Vol. 4, p. 408 (1939).
[172] Bennett, Chem. Formulary, Vol. 4, p. 409 (1939).
[173] Bennett, Chem. Formulary, Vol. 4, p. 409 (1939).
[174] Crowley, Money Making Formulas.
[175] Bennett, Chem. Formulary, Vol. 4, p. 411 (1939).
[176] Bennett, Chem. Formulary, Vol. 3, p. 284 (1936).
[177] Bennett, Chem. Formulary, Vol. 1, p. 426 (1933).
[178] Personal Communication.
[179] Bennett, Chem. Formulary, Vol. 1, p. 425 (1933).
[180] Bennett, Chem. Formulary, Vol. 4, p. 413 (1939).
[181] Bennett, Chem. Formulary, Vol. 4, p. 413 (1939).
[182] Bennett, Chem. Formulary, Vol. 4, p. 413 (1939).
[183] Bennett, Chem. Formulary, Vol. 4, p. 413 (1939).
[184] Bennett, Chem. Formulary, Vol. 4, p. 413 (1939).
[185] Bennett, Chem. Formulary, Vol. 4, p. 412 (1939).
[186] Bennett, Chem. Formulary, Vol. 4, p. 412 (1939).
[187] Bennett, Chem. Formulary, Vol. 5, p. 335 (1941).
[188] Bennett, Chem. Formulary, Vol. 5, p. 531 (1941).
[189] Bennett, Chem. Formulary, Vol. 4, p. 418 (1939).

[190] Bennett, Chem. Formulary, Vol. 5, p. 531 (1941).

[191] Personal Communication.

[192] Bennett, Chem. Formulary, Vol. 4, p. 416 (1939).

[193] Personal Communication.

[194] Bennett, Chem. Formulary, Vol. 4, p. 416 (1939).

[195] Personal Communication.

[196] Bennett, Chem. Formulary, Vol. 4, p. 416 (1939).

[197] Bennett, Chem. Formulary, Vol. 4, p. 408 (1939).

[198] Bennett, Chem. Formulary, Vol. 4, p. 408 (1939).

[199] Bennett, Chem. Formulary, Vol. 4, p. 408 (1939).

[200] Bennett, Chem. Formulary, Vol. 4, p. 408 (1939).

[201] Bennett, Chem. Formulary, Vol. 4, p. 408 (1939).

[202] Bennett, Chem. Formulary, Vol. 4, p. 408 (1939).

[203] Bennett, Chem. Formulary, Vol. 4, p. 408 (1939).

[204] Bennett, Chem. Formulary, Vol. 4, p. 408 (1939).

[205] Bennett, Chem. Formulary, Vol. 4, p. 408 (1939).

[206] Personal Communication.

[211] Personal Communication.

[212] Bennett, Chem. Formulary, Vol. 4, p. 430 (1939).

[213] Crowley, Money Making Formulas.

[214] Bennett, Chem. Formulary, Vol. 2, p. 297 (1935).

[215] Bennett, Chem. Formulary, Vol. 1, p. 425 (1933).

[216] Bennett, Chem. Formulary, Vol. 1, p. 424 (1933).

[217] Bennett, Chem. Formulary, Vol. 1, p. 427 (1933).

[218] Personal Communication.

CHAPTER XXIX

RESIN AND RUBBER EMULSIONS

Rosin Emulsions

Formula No. 1[1]

Rosin	700
Water	2100
Glue	150

Melt glue in water and, while boiling hot, slowly add melted rosin, agitating violently. Continue agitation until perfectly smooth.

Formula No. 2[2]

Rosin	700
Water	2100
Gelatin	150

Melt gelatin in water and, while boiling hot, add melted rosin slowly, agitating violently. Continue agitation until perfectly smooth.

Formula No. 3[3]

Rosin	700
Water	2100
Stearic Acid	63
Triethanolamine	21

Melt rosin and stearic acid together. Add triethanolamine to water. Heat water to boiling point and stir in melted rosin. Stir until smooth.

Formula No. 4[4]

a. Rosin	100
b. Naphtha	100
c. Ammonium Linoleate	3
d. Ammonium Hydroxide	2½
e. Water	200

Heat *a* to 150°C. and turn off flame; run *b,* which has been previously heated on a water-bath to 90°–100°C., into it slowly and stir until all rosin has dissolved. Cool and add slowly with vigorous stirring *c, d,* and *e* mixed together.

Formula No. 5[5]

Rosin, Ester Gum, Cumar, or Other Resin (Melted)	3 lb.
Oleic Acid	1 oz.
Triethanolamine	2 oz.
Casein Solution	2 lb.
Water	To make 1 gal.

Rosin-turpentine Emulsion[6]

Rosin	11.0
Turpentine	2.5
Ammonium Linoleate	2.0
Water	50.0
Ammonia	15.0

The ammonium linoleate and water are taken up in the usual way; heated, and mechanically agitated (high-speed mixer). The rosin and turpentine are heated together and added to the ammonium linoleate dispersion in water to which has previously been added the 15 cc. of ammonia. Stirring is continued until cool.

This gives a paste emulsion.

Paraffin-Rosin Emulsion[7]

In producing these dispersions, various proportions of paraffin and rosin may be used, from as high as 85% paraffin and as low as 15% rosin to as low as 15% paraffin and as high as 85% rosin. Assuming that a mixture of about 50% paraffin and about 50% rosin is employed, the mixture is melted and heated to about 220°F., which temperature is materially above the melting point of the paraffin (130°F.) and above the melting point of the rosin (about 180°F.). The heat-liquefied thermoplastic mixture is then commingled as a regulated stream flowing, say, at the rate of 15 lb. per minute with a regulated stream of 5% caustic soda solution at 110°F., flowing, say, at the rate of 20 lb. per minute. Under these conditions and at a temperature of about 155°F., an aqueous dispersion of a solids content of about 45% is produced, which, when suddenly chilled to a temperature below 130°F. to prevent coalescence of dispersed particles, is of a creamy consistency.

Asphalt-Rosin Emulsion[8]

In producing asphalt dispersions, at least about 35% rosin, based on the total weight of thermoplastic material, should be used in order to produce a stable dispersion of fine particle size. Assuming that a mixture of about 50% asphalt having a melting point of about 150°F. and about 50% rosin is employed, the mixture should be heated to about 300°F., whereupon it is brought in contact with a caustic soda solution under practically the same conditions as in the case of the paraffin dispersion, except that the solution should be at 150° to 160°F. The resulting dispersion has a temperature of about 200°F. and, when permitted to cool, is of a smooth, soft, paste-like consistency.

Cumar Emulsion [9]

a.	Naphtha	20
	Cumar	20
b.	Ammonium Linoleate Paste	10
	Water	40

Heat *a* until dissolved; while at 90–100°C. add *b* (at 90–100°C.) slowly with vigorous stirring.

Gelva Resin Emulsion [10]

Polyvinylacetate Resin (Gelva)	25.0
Toluol	55.0
Butyl Acetate	20.0
Water	39.4
Sodium Lauryl Sulfate	0.2
Sulfonated Castor Oil	0.4

Pentaerythritol Abietate Emulsion [11]

Pentaerythritol Abietate	50.0
Oleic Acid	20.0
Triethanolamine	4.2
Mineral Spirits	15.0
Water	500.0

Staybelite Ester Emulsions [12]

FORMULA	No. 1	No. 2	No. 3	No. 4
	Method A		*Method B*	
Staybelite Ester No. 10, 1, or 2 (80% Solution*)	100.0	....	47.5	....
Staybelite Ester No. 3 (Solids Basis)	....	80.0	....	42.0
Duponol ME	0.8	2.0	....	....
Potassium Hydroxide	....	....	0.3	0.3
Oleic Acid	....	....	1.1	1.2
Sulfated Castor Oil (75%)	0.8	2.0	0.9	1.0
Water	138.4	136.0	50.2	55.5
% Solids	37	38	40	45

*** In Varsol, HF naphtha, toluene, xylene, tollac, Solvesso No. 2, Solvent 50D, etc.**

Emulsions of Staybelite esters may be prepared by two general methods, Methods A and B. Method A requires the use of a colloid mill and only a minimum of emulsifier. Method B yields spontaneous emulsions on rapid agitation, but requires the use of large amounts of a soap such as potassium oleate. Staybelite Esters No. 10, 1, and 2 are introduced as 80% solvent solutions; Staybelite Ester No. 3 is so fluid it may be emulsified without the aid of solvent.

Method A. Blend the solvent solution of the Staybelite ester (in the case of Staybelite Ester No. 3, where no solvent is used, warm to 90°C. before blending) with the water containing the Duponol ME and sulfated castor oil, then pass through colloid mill.

Method B. Stir the oleic acid into the solvent solution of the Staybelite ester (or into the resin itself, when Staybelite Ester No. 3 is used). Dissolve all the potassium hydroxide and sulfated castor oil in half the water. Add the resin-oleic acid mixture to this solution with vigorous agitation to produce a spontaneous emulsion. Stir vigorously for 10–15 minutes, dilute with remaining water, stir 30–40 minutes, filter, and the emulsion is ready for use.

Ethyl Cellulose Emulsions

	Formula No. 1[13]	No. 2[14]	No. 3[15]
a. Ethyl Cellulose	5.0	5.0	5.0
Octyl Acetate	63.0	5.0	5.0
Toluol	63.0	63.0	63.0
Diphenyl Oxide	0.6	1.4	1.0
Dow Plasticizer No. 6	1.4	0.6	1.0
b. Deceresol O. T.	2.0	2.0	2.0
Water	13.0	13.0	13.0

Add *b* to *a* slowly while mixing vigorously with an electrical mixer.

Formula No. 4[16]
(Laminating Adhesive)

25% Solids High-viscosity Ethyl Cellulose Dissolved in 80:20 Ratio of Toluene and Ethyl Alcohol	100

Staybelite Ester No. 3	20
Water Containing 1 Part 28% Ammonia	30

The Staybelite Ester No. 3 is dissolved in the ethyl cellulose solution. To this resin-modified solution the water phase is added, with slow agitation, to produce a homogeneous stable water-in-oil reversed emulsion.

Methyl Methacrylate Emulsions

Formula No. 1[17]

a. Monomeric Methacrylate	25
b. Dibutyl Phthalate	5
c. Deceresol O. T. (10%)	4
d. Water	64
e. Hydrogen Peroxide (30%)	3

Mix *a* and *b* and add slowly to mixture of *c, d,* and *e,* stirring well. Then pass through a colloid mill or homogenizer.

Formula No. 2[18]

a. Monomeric Methacrylate	12.5
Monomeric Styrene	12.5
b. Dibutyl Phthalate	5.0
c. Deceresol O. T. (10%)	4.0
d. Water	64.0
e. Hydrogen Peroxide	2.0

Formula No. 3[19]

Methyl Methacrylate	30.0
Water	100.0
Ammonium Persulfate	0.3

Heat to 80°C. and mix vigorously.

Formula No. 4[20]
(Flexible Coating for Cloth)

Methyl Methacrylate	2.50 lb.
Potassium Persulfate	0.05 oz.

Soap	5.60 oz.
Water	10.00 lb.

The materials are placed in a closed container and agitated at 50°C. for 1 day or may be stirred in an open vessel fitted with a reflux condenser. The product is an emulsion of a flexible polymer.

Cloth is coated by passing it through this emulsion. The dried coating is resistant to water and many organic solvents.

Natural Resin Emulsions

Formula No. 1[21]

Elemi	58
Batavia Dammar	14
Water	128
Triethanolamine	3
Oleic Acid	7
Commercial Latex Solution (About 36% Latex)	70

Melt the elemi and stir in the dammar. Raise the temperature to 125°C. When the mixture is homogeneous, allow to cool and set the container into a boiling water bath. Add the oleic acid and then the triethanolamine with stirring. Add the water, pre-heated to boiling, portion by portion, stirring and incorporating after each small portion has been added before adding the next portion. The mixture thickens at first but as additions of water continue it changes to a thin white liquid. After all the water has been added, allow the mixture to cool but continue the stirring until it is cool. Add the latex solution with stirring.

Formula No. 2[22]

Manila DBB (Ground)	144
Water	206
Ammonium Hydroxide	60
Commercial Latex Solution (About 36% Latex)	3690

Mix the Manila, water and ammonia until all the resin dissolves. Strain. To this solution, add the latex solution.

Formula No. 3 [23]

Manila DBB	144
Water	206
Ammonium Hydroxide	60
Commercial Latex Solution (About 36% Latex)	1230

Mix the Manila, water and ammonia until all the resin dissolves. Strain. To this solution, add the latex solution.

Cellulose Ester Emulsion [24]

A pyroxylin base is prepared by colloiding 12.5 parts by weight of alcohol-wetted pyroxylin (10 parts of dry ½ sec. pyroxylin) with 20 parts by weight of blown linseed oil in a suitable mixer, such as the Werner and Pfleiderer mixer. Twenty-five parts by weight of a solvent mixture are then added to the colloided mass in portions equalling 5 parts by weight, to form a homogeneous base having the following composition:

Pyroxylin (½ sec.)	10
Alcohol (Denatured)	2½
Blown Linseed Oil	20
Butyl Acetate	20
Butyl Lactate	5

An emulsion is prepared by heating 0.5 part by weight of sodium oleate with 15 parts by weight of gasoline to a clear gel; after which 2 parts by weight of water are added to the hot gel with vigorous stirring, thus forming a concentrated emulsion of gasoline in water that is stabilized by sodium oleate. For convenience this will hereafter be called the agent emulsion.

The presolution or solvating of the sodium oleate in gasoline or some similar liquid is desirable to assure uniform distribution.

Into 57.5 parts by weight of the pyroxylin base, 17.5 parts by weight of the agent emulsion are then stirred vigorously with a high-speed stirrer of the propeller blade type.

Polystyrene Resin Emulsion[25]

a.	Polystyrene Resin	7.5
	Toluol	22.5
	Octyl Acetate	6.5
b.	Emulsifying Agent (Deceresol O. T.)	1.0
	Diglycol Laurate	0.5
	Water	12.5
c.	Toluol	50.0

Dissolve *a;* to this add *b* slowly while mixing vigorously, then add *c* and stir until uniform.

This gives a stable film-forming emulsion.

Vinylite Emulsions

One of the most satisfactory emulsifying agents is ammonium oleate, prepared "in situ" by adding oleic acid to the lacquer phase and an excess of ammonia to the water phase. Triisopropanolamine oleate prepared in a similar manner can be used if the volatility of ammonia is undesirable. Sodium lauryl sulfonate may also be used and this is dissolved entirely in the water phase. The amount of emulsifying agent required is of the order of 0.5–5% of the weight of resin present, the exact amount varying for specific agents and specific types of emulsions.

A small amount (0.5% of resin weight) of bentonite clay dispersed first in a little water and then added to the finished emulsion improves the stability upon storage appreciably. This should not be added to the water phase before emulsification. A ball mill is suggested as a suitable means of preparing the preliminary bentonite dispersion.

Formula No. 1[26]
(Plasticized Vinylite Resin AYAA Emulsion)

Vinyl Resin AYAA	50.0
Tricresyl Phosphate	5.0
Toluene	43.5
Oleic Acid	1.5
Distilled Water	92.0
Aqua Ammonia	8.0

Formula No. 2[27]
(Emulsion Polymerization of Vinyl Acetate)

a. Water	50.00
Aerosol OT	2.50
Potassium Metabisulfite	0.05
b. Vinyl Acetate	10.00

Dissolve *a*, add *b*, stir. Heat for 1 hour at 60–65°C.

Rubber Emulsions

Formula No. 1[28]

Rubber	70
Bentonite	1¼
Water	10¾

Formula No. 2[29]

A mixture of 100 parts rubber, 10–100 parts benzene, 1 part glue and 1 part casein is masticated, while an aqueous solution of potassium oleate is slowly added until the rubber constitutes the dispersed phase of the batch. The product is suitable for use as a cementing medium.

Formula No. 3[30]
(Artificial Latex)

Reclaimed Rubber	48.5
Cumar, Mineral Rubber or Gum Rosin	2.5
Rosin Soap	9.0
Whiting	40.0
Water	To suit

The reclaimed rubber and softener are mixed together in a Banbury mixer for approximately 20 minutes. The whiting and rosin soap are made into a stiff putty-like paste with water. This paste is then placed in a Werner-Pfleiderer mixer and the rubber-softener blend added gradually to the paste in the mixer. This process will require 30 to 80 minutes, during which time the mixer should be heated with steam passing through the jacket to a temperature of approximately 180°F. The mixing is continued until the rubber is completely dispersed in the form of fine particles 2–20 mu. in diameter. The dispersion thus made can be diluted as desired with water to reduce the viscosity. Bodying agents such as gum tragacanth and curing ingredients may be added with the water.

Formula No. 4 [31]

(Synthetic Rubber Emulsion Polymerization)

Butadiene	7.5
Styrene	2.5
Isohexyl Mercaptan	0.05
Water	18.0
Sodium Oleate	2.0
Ammonium Persulfate	0.03

The temperature is 30°C.; the time is several days.

Rubber Resin Emulsion

Formula No. 1 [32]

a. Rubber Resin	40
b. Ammonium Linoleate Paste	10
c. Water	150

Heat *a* and *b* until homogeneous and add *c* to it slowly with vigorous mixing.

Formula No. 2[83]
(Insole Cement)

Latex (40% Solids)	100
Casein Solution (10%)*	10–15
Resin Emulsion (50%)**	10

Chlorinated Rubber Emulsions

Formula No. 1[84]

Stable emulsions can easily be obtained without the use of emulsifying agents, with, for example, 70 g. of chlorinated rubber, 30 g. xylol and 40 g. of water, by feeding each of these simultaneously and progressively into a stirring device in operation.

Formula No. 2[85]

Casein	2.0
Ammonia (28%)	0.1
Turkey Red Oil	6.0

Heat to 35°C. with stirring and add slowly a solution of

Chlorinated Rubber	20
Trichlorethylene	80

Stir until uniform. This disperses well in water.

Formula No. 3[86]

Twenty parts, by weight, of oleic acid, saponified with 20 parts of sodium silicate in 200 parts of water, are stirred at 100°C. into 5 parts of chlorinated rubber dissolved in 25 parts resin oil; 125 parts of water containing 8 parts of casein and 0.5 parts of ammonia are then added.

---

* Casein Solution

Casein	5 lb.
Water	44 lb.
Ammonium Hydroxide	8 oz.
Phenol	1 oz.

** Resin Emulsion

Resin (Ester Gum or Cumar)	3 lb.
Oleic Acid	3 oz.
Ammonium Hydroxide	1 oz.
Water	3 lb.

The oleic acid and ammonium hydroxide are dissolved in the water and the resin is emulsified by heating to the melting point and stirring vigorously.

Formula No. 4[37]

Chlorinated Rubber	100.0
Hydrogenated Methyl Abietate	15.0
Oleic Acid	4.9
Toluol	16.0
Xylol	110.0
Water	98.5
Caustic Soda	0.7

REFERENCES

[1] Bennett, Chem. Formulary, Vol. 1, p. 155 (1933).
[2] Bennett, Chem. Formulary, Vol. 1, p. 155 (1933).
[3] Bennett, Chem. Formulary, Vol. 1, p. 155 (1933).
[4] Bennett, Chem. Formulary, Vol. 1, p. 443 (1933).
[5] Bennett, Chem. Formulary, Vol. 2, p. 189 (1935).
[6] Bennett, Chem. Formulary, Vol. 1, p. 163 (1933).
[7] Bennett, Chem. Formulary, Vol. 2, p. 189 (1935).
[8] Bennett, Chem. Formulary, Vol. 2, p. 189 (1935).
[9] Bennett, Chem. Formulary, Vol. 2, p. 188 (1935).
[10] Billing, U. S. 2,230,792 (1941).
[11] U. S. 2,333,887.
[12] Bennett, Chem. Formulary, Vol. 7, p. 113 (1945).
[13] Bennett, Chem. Formulary, Vol. 5, p. 73 (1941).
[14] Bennett, Chem. Formulary, Vol. 5, p. 73 (1941).
[15] Bennett, Chem. Formulary, Vol. 5, p. 73 (1941).
[16] Bennett, Chem. Formulary, Vol. 7, p. 40 (1945).
[17] Bennett, Chem. Formulary, Vol. 5, p. 73 (1941).
[18] Bennett, Chem. Formulary, Vol. 5, p. 73 (1941).
[19] Bennett, Chem. Formulary, Vol. 5, p. 550 (1941).
[20] Bennett, Chem. Formulary, Vol. 7, p. 285 (1945).
[21] American Gum Importers' Assn.
[22] American Gum Importers' Assn.
[23] American Gum Importers' Assn.
[24] U. S. 1,970,572.
[25] Bennett, Chem. Formulary, Vol. 5, p. 72 (1941).
[26] Carbide & Carbon Chemicals Corp., New York, N. Y. (Catalog).
[27] Bennett, Chem. Formulary, Vol. 7, p. 357 (1945).
[28] U. S. 1,498,387.
[29] Bennett, Chem. Formulary, Vol. 1, p. 163 (1933).
[30] Bennett, Chem. Formulary, Vol. 5, p. 543 (1941).
[31] U. S. 2,281,613.
[32] Bennett, Chem. Formulary, Vol. 5, p. 72 (1941).
[33] Bennett, Chem. Formulary, Vol. 7, p. 43 (1945).
[34] Bennett, Chem. Formulary, Vol. 4, p. 98 (1939).
[35] Bennett, Chem. Formulary, Vol. 4, p. 98 (1939).
[36] Bennett, Chem. Formulary, Vol. 3, p. 110 (1936).
[37] Billing, U. S. 2,230,792 (1941).

CHAPTER XXX

TEXTILE EMULSIONS

Textile Sizings

Formula No. 1[1]

Batavia Dammar A/D	10
Stearic Acid	10
Morpholine	1
Water	100

Melt the dammar and stearic acid. Keeping the temperature at 90–95°C., stir in the morpholine and the water which has been preheated to 90–95°C.

Formula No. 2[2]

White Beef Tallow	30
Sulfonated Tallow (50%)	30
Japan Wax Emulsion	6– 8
Water	32–34
Disinfectant or Deodorant	1– 2

Melt Japan wax and sulfonated tallow while agitating; when thoroughly melted add beef tallow and stir until thoroughly mixed. Then add water gradually and agitate until a full white creamy mix is secured.

Formula No. 3[3]

Rosin	24–60
Linseed Oil	24–60
Alkaline Casein Dispersion	8–10
Sodium Silicate	5–10
Water	500

Formula No. 4[4]

Water	59.6
Beeswax	9.4
Japan Wax	11.0
Stearic Acid	11.0
Oleic Acid	3.0
Caustic Soda	3.0
Olive Oil	3.0

Formula No. 5[5]

Linseed Oil	100
Trichlorethylene	100
Ammonium Linoleate	16
Water	100–200

Formula No. 6[6]

Paraffin Wax	40
Oleic Acid	5
Trigamine	3
Water	112

The trigamine is dissolved in the water and the oleic acid is added, stirring thoroughly until completely homogeneous. This is then heated to 65–70°C. and the wax, previously melted, added with rapid agitation. Stirring is continued until the emulsion is cold.

Formula No. 7[7]

Melt together at a temperature of 50–60°C. equal parts of olein and dried soya bean phosphatides obtained by extraction with 90 parts of benzol and 10 parts of 96% alcohol. Then by adding an equal quantity of water, keeping the temperature at 50–60°C. and adding small quantities of dilute soda lye, the mixture is emulsified under vigorous stirring. When required for use, this emulsion is diluted with further quantities of water in the desired manner.

Formula No. 8[8]

Rosin	10–15
Olein	2–10
Triethanolamine	7–20
Stearin	7–20
Water	1000

Sizing is done at 50°C. for 15 minutes. The temperature is then raised to 60°C.

Desizing or washing is done with 0.5% soap solution at 60°C. for 1 hour.

Formula No. 9[9]

Sulfonated Castor Oil (58%)	50
Paraffin Oil (28° Bé.)	10
Caustic Soda Solution (27° Bé.)	12
Water	23
Steam-distilled Pine Oil	12

Mix ingredients in order named at 35–40°C., being careful to add caustic soda solution and pine oil very slowly, with constant stirring and allowing mixture to cool to room temperature as the pine oil is being added.

Anti-static Textile Dressing[10]

a.	Magnesium Chloride (10% Solution)	7
	Water	50
b.	Mineral Oil	80
	Sulfonated Lauryl Alcohol	25
	Lauryl Alcohol	5
	Oleic Acid	7
	Water	50

Add to *b* previously prepared *a*.

This is used on cellulose acetate staple fiber to the extent of 1–4%.

Kier Penetrant Oil[11]

Xylol	10
Water	20
Sulfonated Castor Oil (62% T.F.M.)	20

Luster Emulsion for Starching[12]

Stearic Acid	1 kg.
White Beeswax	200 g.
Borax	67–75 g.
Water	4 kg.
Citronella Oil for Perfume	5 g.

Of this emulsion, 10 spoonfuls are used for 1 kg. of starch.

Rot-proofing Emulsion[13]

a. Zinc Naphthenate	60.0
b. Mineral Spirits	17.5
c. Emulsifying Agent	2.5
d. Water	20.0

Dissolve *a* in *b* and add slowly, with vigorous mixing, to *c* and *d* (mixed); mix until emulsified.

The emulsion is diluted, as desired, with water before use.

Textile-scouring Assistant[14]

Dupanol LS Paste	15
Hexalin	2
Pine Oil	3
Tetralin	70
Water	10

Degreasing Emulsion[15]

Kerosene	60
Dupanol LS Paste	5
Water	35

Soapy Fulling Oil [16]

a.	Oleic Acid	70
	Methyl Cyclohexanol	5
	Carbon Tetrachloride	20
b.	Caustic Potash (50° Bé.)	

To *a* add enough *b* to just neutralize to phenolphthalein.

Textile Softeners

Formula No. 1 [17]

Water	7
Soap	3
Tallow	1

Formula No. 2 [18]

Tallow	100
Caustic Potash (45%)	30

Formula No. 3 [19]

Lecithin	5– 10
Cyclohexanol	50– 100
Tetralin	500–1000
Water	1000

Formula No. 4 [20]

Mineral Oil	10
Glue, Hide	10
Dupanol WS	2
Water	78

Textile Gloss Oil

Formula No. 1 [21]

Paraffin Wax	20
Lanette Wax SX	10
Water	70

Heat together and stir until dispersed.

Formula No. 2[22]

Paraffin Wax	20
Petrolatum, White	2
Glycosterin	10
Water	180

Heat together and stir until dispersed.

Yarn Finish

Formula No. 1[23]

Potash Carbonate	2
Rosin	7
Paraffin Wax, Soft	10
Montan Wax, Bleached, A	10
Water	65

Formula No. 2[24]

Montan Wax, Double-bleached	8
Paraffin Wax (40/42°C.)	10
Rosin	7
Potassium Carbonate	2
Water	60

"Soluble" Textile Oils

	Formula No. 1[25]	Formula No. 2[26]
Mineral Oil (55 Sec. Saybolt)	70	82
Oleic Acid	15	3
Sodium Petroleum Sulfonates	15	5
Lard Oil	..	10

Formula No. 3[27]

Xylol or Toluol	15
Paraffin Oil (28° Bé.)	78
Red Oil	2
Alcohol	3
Caustic Soda Solution (27° Bé.)	1
Water	1

Mix the paraffin oil and red oil, heat to 40°C., add the previously mixed water and caustic solution; add the xylol slowly and the alcohol last. When the mixture is uniform, cool as quickly as possible.

Formula No. 4 [28]

Water	2.0
Caustic Potash	1.2
Light Mineral Oil	85.0
Diethylene Glycol	2.0
Oleic Acid	9.9

To the mineral oil add 6 parts of oleic acid and the caustic potash dissolved in the water. Stir in the diethylene glycol. Then add slowly, with constant stirring, the remainder of the oleic acid, till the solution becomes clear. If properly made, this oil will emulsify when mixed with water.

Formula No. 5 [29]

a. Turkey Red Oil (50%)	30
Diglycol Laurate	1
Alcohol	1
Methyl Glycol	1
b. Oleic Acid, White	15
c. Caustic Potash	To neutralize
Water	To make 100

Formula No. 6 [30]

Of an oil such as a mineral oil, 64 parts are used in admixture with 2 parts of Carbitol, 14 parts of corn oil soap, 10 parts of rosin, 6 parts of water, and 4 parts of diethylene glycol.

Formula No. 7 [31]

a. Oleic Acid	8.0
Colza Oil	4.0
Rosin	2.0
Castor Oil Fatty Acid	2.0
Spindle Oil	32.0

b.	Alcohol	2.0
	Methyl Glycol	1.0
c.	Caustic Potash (50°)	3.8

Textile-scouring Emulsion[32]

Oleic Acid	10
Pine Oil	87
Trigamine	3
Water	100

Mix 30 parts of the pine oil with the trigamine and oleic acid and stir thoroughly. Then add slowly 35 parts of water and stir till a smooth thick emulsion is formed. Then add the remainder of the oil with high speed agitation and finally the rest of the water.

Non-slippery Belt and Rope Preservative[33]

a.	Tallow	6
	Beeswax	1
	Soap	3
b.	Water (Boiling)	30

Melt *a* together and add slowly *b* with vigorous stirring. When emulsion is complete, dilute with water to a density of 0.950.

Spinning Oil for Light or White Fibers[34]

a.	White Oleic Acid	41
	Denatured Alcohol	31
	Caustic Potash (48° Bé.)	17½
b.	Water	11
	White Mineral Oil	854
	White Oleic Acid	35

Mix *a* thoroughly and test for neutrality. Make exactly neutral, then add *b*.

Rope Preservative [35]

Tallow	6
Beeswax	1
Water	30
Soap	3

Textile Lubricants

Formula No. 1 [36]

Olive Oil	87
Oleic Acid	10
Trigamine	3
Water	100

Formula No. 2 [37]

Oleic Acid	40.00
Triethanolamine	2.04
Water	60.00

Stir together at about 35°C., and transfer immediately into a homogenizer, where the emulsion is homogenized under about 150 atmospheres pressure.

Formula No. 3 [38]

a. Monoamylamine Oleate	4
Paraffin Oil (28° Bé.)	96
b. Water	100

Mix *a* and stir into *b*.

Oil Coating for Glass Fibers [39]

Bright Stock (Petroleum) Oil	20 –40
Oleic Acid	12.6–18.5
Ammonia (28°)	4
Water	To make 100

Acetate Rayon Oil [40]

Sulfonated Castor Oil (65%)	50
Commercial Olive Oil	45

Acetic Acid (28%)	20
Paraffin Oil (28° Bé.)	5
Water	100

Mix the three oils and the water at 40°C. Then cool to 30°C., and stir the acetic acid into mixture slowly.

Waterproofing (Acetate) Rayon[41]

Paraffin Wax	5 g.
Soap	5 g.
Ammonium Hydroxide (0.880)	30 cc.
Water	970 cc.

Heat to 55°C. and stir vigorously until a uniform emulsion results. Soak the rayon in this emulsion at 45°C. for 15 minutes; remove; centrifuge and treat for 10 minutes at 20°C. with a 5°Tw. solution of aluminum acetate.

Rayon Delustering[42]

Olive Oil Soap (Low Titer)	10
White Glue	10
Water	100

Dissolve by warming and stirring; add paraffin wax.
Heat and stir till emulsified.
Take 2½ parts of above emulsion and add to it

Water	100

Stir and add

Infusorial Earth	2.27–4.54

Mothproofing Emulsion[43]

a.	Santochlor	16
	Stearic Acid	1
	Carbon Tetrachloride	4
b.	Carbowax 4000	6
	Triethanolamine	3
	Water	5

Solution *a*, prepared by mixing Santochlor, stearic acid and carbon tetrachloride, is added with rapid agitation to solution *b*, prepared by dissolving the Carbowax and triethanolamine in water.

REFERENCES

[1] Bennett, Chem. Formulary, Vol. 5, p. 591 (1941).
[2] Personal Communication.
[3] Lefranc, U. S. 1,861,927 (1932).
[4] Bennett, Chem. Formulary, Vol. 4, p. 529 (1939).
[5] Bennett, Chem. Formulary, Vol. 1, p. 475 (1933).
[6] Bennett, Chem. Formulary, Vol. 4, p. 553 (1939).
[7] Personal Communication.
[8] Bennett, Chem. Formulary, Vol. 2, p. 468 (1935).
[9] Bennett, Chem. Formulary, Vol. 3, p. 365 (1936).
[10] Bennett, Chem. Formulary, Vol. 5, p. 595 (1941).
[11] Bennett, Chem. Formulary, Vol. 3, p. 365 (1936).
[12] Bennett, Chem. Formulary, Vol. 5, p. 596 (1941).
[13] Bennett, Chem. Formulary, Vol. 5, p. 593 (1941).
[14] E. I. du Pont de Nemours and Co., Wilmington, Del.
[15] E. I. du Pont de Nemours and Co., Wilmington, Del.
[16] Bennett, Chem. Formulary, Vol. 4, p. 527 (1939).
[17] Bennett, Chem. Formulary, Vol. 4, p. 526 (1939).
[18] Bennett, Chem. Formulary, Vol. 4, p. 526 (1939).
[19] Bennett, Chem. Formulary, Vol. 4, p. 526 (1939).
[20] E. I. du Pont de Nemours and Co., Wilmington, Del.
[21] Bennett, Chem. Formulary, Vol. 2, p. 455 (1935).
[22] Bennett, Chem. Formulary, Vol. 2, p. 455 (1935).
[23] Bennett, Chem. Formulary, Vol. 5, p. 596 (1941).
[24] Bennett, Chem. Formulary, Vol. 4, p. 188 (1939).
[25] Kinney, Can. 284,807 (1928).
[26] Kinney, Can. 284,807 (1928).
[27] Bennett, Chem. Formulary, Vol. 3, p. 365 (1936).
[28] Bennett, Chem. Formulary, Vol. 4, p. 188 (1939).
[29] Bennett, Chem. Formulary, Vol. 4, p. 188 (1939).
[30] Bennett, Chem. Formulary, Vol. 3, p. 365 (1936).
[31] Bennett, Chem. Formulary, Vol. 4, p. 187 (1939).
[32] Bennett, Chem. Formulary, Vol. 4, p. 499 (1939).
[33] Bennett, Chem. Formulary, Vol. 5, p. 593 (1941).
[34] Bennett, Chem. Formulary, Vol. 4, p. 188 (1939).
[35] Pfahl. Brit. 488,643 (1938).
[36] Bennett, Chem. Formulary, Vol. 4, p. 187 (1939).
[37] Bennett, Chem. Formulary, Vol. 4, p. 187 (1939).
[38] Bennett, Chem. Formulary, Vol. 4, p. 187 (1939).
[39] Bennett, Chem. Formulary, Vol. 4, p. 215 (1939).
[40] Bennett, Chem. Formulary, Vol. 3, p. 364 (1936).
[41] Bennett, Chem. Formulary, Vol. 2, p. 468 (1935).
[42] Bennett, Chem. Formulary, Vol. 2, p. 468 (1935).
[43] Bennett, Chem. Formulary, Vol. 7, p. 402 (1945).

CHAPTER XXXI

WATERPROOFING EMULSIONS

Textile-waterproofing Emulsions

Formula No. 1[1]

A

Soap	10.0
Water	20.0
Gelatin	5.5
Water	23.0
Paraffin Wax	20.0

B

Aluminum Sulfate	8.0
Water	20.0
Soda Ash	0.5
Water	2.0
Formaldehyde	0.2
Emulsified Mixture A & B	30.0
Tapioca	7.0
Water	50.0
Titanium Dioxide	5.0
Water	5.0
Benzoic Acid	2.0

Formula No. 2[2]

Cumar	4
Carnauba Wax	15
Trihydroxyethylamine Stearate	7½
Triethanolamine	2½
Water	185

Formula No. 3 [3]

Ethylene Dichloride	40
Naphtha	40
Diglycol Oleate	15
Caustic Soda (50%)	3
Glycerin	25

Formula No. 4 [4]

Ethyl Cellulose	16.6
Hydrogenated Methyl Abietate	3.4
Toluol	56.0
Butanol	16.0
Naphtha	8.0
Water	1500.0
Sodium Lauryl Sulfate	7.5
Sulfonated Castor Oil	15.0

Formula No. 5 [5]

Japan Wax	80.6
Paraffin Wax	9.0
Duponol WA Paste	5.7
Caustic Soda (10% Solution)	5.7
Perfume	To suit

Formula No. 6 [6]

Japan Wax	17½
Tallow Oil	17½
Diglycol Laurate	15
Water	50
Mineral Oil	40
Carbitol	3
Diglycol Laurate	12
Water	45

Formula No. 7 [7]

Paraffin Wax	2
Carnauba Wax	2
Triethanolamine Linoleate	10
Borax	3
Water	30

Formula No. 8[8]

Paraffin Wax	10
Mineral Oil	50
Ammonium Stearate (Paste)	20
Water	70

Formula No. 9[9]

Hard Paraffin Wax	50
Petrolatum, Yellow	400
Peanut Oil	200
Beeswax, Yellow	100
Lanolin, Anhydrous	60
Rosin, Pale	40
Water	140
Borax	10

Formula No. 10[10]

Paraffin Wax	15
Resin RH 35	15
Gum Arabic	5
Water	70
Preservative (Moldex)	1/10

Waterproofing for Leather[11]

Gasoline	100 cc.
Paraffin Wax	25 g.
Paraffin Oil	10 g.
Rubber Latex	100 cc.
Soap (10% Solution)	50 cc.

REFERENCES

[1] Scholler, U. S. 2,230,656 (1941).
[2] Personal Communication.
[3] Personal Communication.
[4] Billing, U. S. 2,230,792 (1941).
[5] E. I. du Pont de Nemours & Co., Wilmington, Del.
[6] Personal Communication.
[7] Personal Communication.
[8] Personal Communication.
[9] Personal Communication.
[10] Personal Communication.
[11] Bradley, U. S. 1,860,651 (1932).

CHAPTER XXXII

WAX EMULSIONS

Bentonite Wax Emulsions[1]

FIRST make a 5% suspension of bentonite, that is, 95% water and 5% bentonite. The easiest way to do this is to put all the water to be used in a vessel and sprinkle a little of the bentonite on the surface. Allow to stand about three minutes or until the bentonite sinks to the bottom. Repeat. Do not stir or agitate. Allow to stand for at least 4 hours, then stir or agitate.

Heat the wax to fluidity. Heat the bentonite dispersion to the same temperature or slightly higher. Pour the wax into the water and stir. Stirring should be particularly vigorous at the point where the wax begins to solidify. A mechanical agitator is the best. In the laboratory use an electric soda-fountain stirrer.

The final mixture may be between 20–50% wax. However, it is best not to use over 40% wax, otherwise the emulsion will be too viscous.

The pH of bentonite in water is 7.5–7.8. In most emulsions a slightly higher pH is desirable, for instance, about 8.5. It would be well to adjust the water dispersion to the higher pH by very slight additions of alkali. Calcium oxide, calcium hydroxide, caustic calcined magnesite, magnesium oxide are recommended.

In some cases it will be found that a thicker dispersion of bentonite and water is desirable. This can be accomplished by using 6% bentonite or by adding very small percentages of other ingredients to the 5% dispersion. These other ingredients should be added *after* the dispersion is made. They will combine the advantages of thickening the dispersion and at the same time raising the pH. Add minute quantities and stir, using just enough to thicken the gel.

In relation to the quantity of bentonite in the dispersion, proper proportions would be as follows:

Calcium Oxide	3%
Calcium Hydroxide	3%
Chloride of Lime	2%
Caustic Calcined Magnesite	0.5–1%
Magnesium Oxide	0.5–1%

For instance, with 95 cc. of water and 5 g. of bentonite, 0.15 g. of calcium oxide would be used. The magnesia compounds react more slowly. The others react practically immeditaely.

Candelilla Wax Emulsions

Formula No. 1[2]

a. Candelilla Wax	30
Triethanolamine	7
Red Oil	5
b. Borax	2½
Water	20
c. Water	150

Formula No. 2[3]

a. Candelilla Wax	20
Oleic Acid	3
b. Triethanolamine	4
Borax	2
Water	185

Heat *a* to 95–100°C. and then run into *b* which has been heated to 95–100°C., mixing with a high-speed stirrer.

Formula No. 3[4]

a. Candelilla Wax	20
Oleic Acid	3

b. Triethanolamine	3
Borax	1½
Water	185

Formula No. 4[5]

Candelilla Wax	23
Ammonium Linoleate S	3
Water	232
Ammonia	2

Melt wax at 100°C. The ammonium linoleate is thinned by working in 30 cc. of water, a little at a time. The balance of water is heated to 95–100°C., and the ammonium linoleate solution is added to it. The whole is boiled and added, a little at a time, while stirring vigorously. Finally add the ammonia and stir until cooled to 50°C.

Carnauba Wax Emulsions

Formula No. 1[6]

Carnauba Wax	260.00
Trihydroxyethylamine Oleate	48.50
Triethanolamine	28.00
Borax	11.11
Caustic Soda (50%)	2.22
Water	650.22

Formula No. 2[7]

Carnauba Wax	16.0 g.
Kerosene	20.0 cc.
Ammonium Linoleate	2.4 g.
Water	200.0 cc.

The ammonium linoleate is placed in a vessel and covered with the water (cold) and allowed to stand overnight. The following day it is warmed and stirred until completely dispersed in the water, taking care that no lumps are left. The dispersion is heated to 90°C. and stirred by means of a high-speed mixer. The wax is melted, heated to 100°C., and the kerosene added and stirred until the wax has dissolved in it. This is then added to the hot ammonium linoleate dispersion and the agitation continued until the emulsion is cool. This gives a fluid emulsion.

Formula No. 3[8]

Mineral Oil (Spindle)	19	cc.
Carnauba Wax	18	g.
Ammonium Linoleate	2.4	g.
Water	102	cc.

Formula No. 4[9]

Hydromalin	138
Carnauba Wax, Yellow, No. 1 or No. 2	250

Heat to 120–140°C. ½ hour. Cool to 100–105°C. Add to the above slowly with stirring.

Water (at 100°C.)	280

Stir to smooth paste then add slowly with good stirring

Water (at 100°C.)	1500

Keep as close to 100°C. as possible for 15 minutes with rapid stirring. Then stir till cool.

Formula No. 5[10]

a.	Carnauba Wax	90 g.
	Oleic Acid	10 g.
	Trigamine	10 g.
b.	Caustic Soda (50%)	6 g.
	Water	24 g.

Melt *a.* Mix *b* together and heat; add to *a* slowly with stirring, and stir the whole until it begins to solidify.

One part of the above disperses easily in 5 parts of boiling water.

Formula No. 6[11]

Carnauba Wax	20.0
Duponol WA Paste	8.0

Borax	1.0
Water	71.0

Melt the carnauba wax in a steam bath and pour it into the Duponol WA paste and borax dissolved in the water at approximately 95°C. Stir vigorously until a smooth emulsion is formed. Then stir gently until the emulsion has cooled to room temperature. A variation of this procedure is to add the Duponol WA paste to the wax which has been melted in a steam bath and then to add the borax, dissolved in the water. Do not stir vigorously until cool.

Formula No. 7[12]

Carnauba Wax	30.0
Oleic Acid	3.3
Caustic Soda	0.5
Triethanolamine	2.7
* Shellac Solution	62.0
Water	260.0
Gelatin	0.30–1.3

Carnauba Wax-Resin Emulsions[13]

Formula	No. 1	No. 2	No. 3	No. 4	No. 5
Carnauba Wax No. 1	45	45	30	30	30
Gum Dammar A	15	15	30	30	30
Manila Gum DBB	5	5	..	..	..
Caustic Soda	1	1.5	0.9	2	2
Water	420	420	422	422	422
Triethanolamine	4	4	..	..	..
Trigamine	..	..	9.9	9.5	19
Oleic Acid	9	9	7	7	14
Stearic Acid	..	..	..	..	..
"Run" Boea (Hard Bold Amber)	..	..	..	..	..
"Run" Congo	..	..	..	..	..
	Film Dull Slight Rubbing Gives Good Gloss	Film Same as No. 1	Film Same as No. 1	Film Same as No. 1	Film Same as No. 1

---

* Shellac Solution

Refined Wax-free Shellac	1.5
Borax	0.38
Water	8.33

Formula	No. 6	No. 7	No. 8	No. 9	No. 10
Carnauba Wax No. 1	33.5	47	47	30	30
Gum Dammar A	26.5	13	13	..	..
Manila Gum DBB	..	..	..	..	..
Caustic Soda	1.5	0.6	0.6	1	0.5
Water	420	420	420	420	420
Triethanolamine	2	4	4	4	4
Trigamine	..	..	..	..	..
Oleic Acid	4	..	9	9	9
Stearic Acid	..	9	..	..	..
"Run" Boea (Hard Bold Amber)	..	..	..	30	..
"Run" Congo	..	..	..	..	..
	Film Glossy	Film Glossy	Film Glossy	Film Glossy	Film Glossy

The procedure used is to melt the wax and to incorporate in it the natural resin (at temperatures of 100–150°C.). This mixture is permitted to solidify and then used as needed in making the emulsion. For this purpose, the resin-wax mixture is melted in a boiling water bath. The emulsifier is added, the oleic acid being first incorporated, followed by the triethanolamine or trigamine. The sodium hydroxide is dissolved in 25 parts of the water, the solution heated, and added at its boiling point. This sometimes causes a gel to form, which is the signal to add the remainder of the water at its boiling point. If a gel does not form, addition of the water is withheld for a few minutes to permit thorough mixing of all constituents.

No. 1 and No. 2 are made slightly different in that the Manila resin is dissolved in the sodium hydroxide solution mentioned above and not in the wax.

Ceresin Wax Emulsion[14]

a. Ceresin Wax	16
b. Aminostearin	4
c. Water	80

Heat *a* and *b* to 85°C., and add slowly with vigorous mixing to the water at 90–100°C.

Esparto Wax Emulsion [15]

a.	Esparto Wax	15
	Triethanolamine	3
	Red Oil	1⅞
b.	Borax	1¼
	Water	10
c.	Water	32½

Heat *a* to 95–100°C. and mix well; run into *b* heated to 95–100°C., beating vigorously; when smooth gel is formed, add *c* heated to 95–100°C. and beat vigorously until cool.

Halowax Emulsions

Formula No. 1 [16]

Water	3 lb.
Halowax	1 lb.
Stearic Acid	53 g.
Triethanolamine	27 g.

Formula No. 2 [17]

Water	3 lb.
Halowax	3 lb.
Stearic Acid	108 g.
Triethanolamine	54 g.

Formula No. 3 [18]

Water	3 lb.
Halowax	13 oz.
Halowax Oil No. 1000	3 oz.
Stearic Acid	108 g.
Triethanolamine	54 g.

Melt the wax and stearic acid together and stir. Heat the water and triethanolamine until they start to boil. Add the wax to the water and stir with an electric stirrer and then run through the colloid mill. A good emulsion is obtained if it is cooled quickly after coming from the colloid mill.

Japan Wax ("Soluble")[19]

a.	Japan Wax	50
	Stearic Acid	14
b.	Trigamine	7

An emulsion is obtained by dispersing one part of above in eight parts of hot water.

Japan Wax Emulsion[20]

a.	Japan Wax	36
	Trihydroxyethylamine Stearate	4
b.	Water, Boiling	360

Warm *a* to 65°C. and add *b* to it slowly, with vigorous stirring.

Self-emulsifying Laundry Wax[21]

Japan Wax	80.6
Paraffin Wax	9.0
Duponol WA Paste	4.7
Caustic Soda (10% Solution)	5.7
Perfume	To suit

Mix the waxes, Duponol WA paste, and caustic soda solution together in a steam-jacketed vessel and stir until thoroughly homogeneous. Cease heating and stir occasionally until almost solid. Then pour into suitable molds to solidify.

Montan Wax Emulsions

Formula No. 1[22]

a.	Montan Wax	20
	Oleic Acid	5
b.	Triethanolamine	8
	Borax	2
	Water	185

Heat *a* to 100°C. and add *b*, which has been heated to 95–100°C., slowly with good mixing.

Formula No. 2[23]

Montan Wax	60 g.
Creosote	40 cc.
Water	100 cc.
Bentonite (6.6% Dispersion)	5 cc.

Formula No. 3[24]

Bleached Montan wax is fused with an equal amount of a solid, wax-like polymerization product of ethylene oxide (softening point about 50°C.) obtained by allowing ethylene oxide to stand at about –10°C. with about 1% its weight of sodium oxide or by heating ethylene oxide with about 0.1% of caustic soda solution to from 50–60°C., the melt then being heated in ten times its weight of water while stirring. An emulsion is obtained which after cooling becomes very viscous and which, if desired, may be further diluted with water while heating, without deflocculation of the wax, and may be employed as a polish. Instead of Montan wax, stearic acid, montanic acid, tallow, wool fat and similar substances may be emulsified in an analogous manner.

Formula No. 4[25]

Montan Wax	160
Ammonium Linoleate	40
Water	600

Dissolve the ammonium linoleate in the water and heat to 95–100°C.; pour the wax into this slowly while stirring vigorously. While still hot, run through a colloid mill.

Opal Wax Emulsions

Formula No. 1[26]

Add desired weight of wax to weighed portion of water. (Emulsions having 40% wax and 60% water form a thick cream. Higher proportions of wax will be solid on cooling.) Heat the water to boiling and continue boiling until wax has completely melted and formed a homogeneous oil film on the surface of the water. Remove from hot plate and after boiling has ceased add NH_4OH while stirring until the melt has a slight but definite ammoniacal odor. Place in a mechanical agitator which will give rapid and thorough stirring (e.g., for small lots the type of mixer used at soda fountains is entirely satisfactory) and continue this stirring until emulsion has cooled below 60°C. Slow cooling in the range from 85–70°C. is advantageous.

Any froth or foam which forms will break upon standing except in the case of the higher wax contents (30% and above), when it may be necessary to apply vacuum to break the foam completely.

In the case of the higher wax contents, only very slow cooling while stirring will prevent the formation of a few small granules of solid wax.

Formula No. 2[27]

a.	Opal Wax	15
	Aminostearin	5
b.	Water	75
	Sulfatate (Wetting Agent)	5

Heat *a* to 100–105°C. and add to it slowly, while mixing with high-speed mixer, *b* heated to 95°C.

Ouricouri Wax Emulsion[28]

Ouricouri Wax	13.2
Diglycol Oleate	2.5
Triethanolamine	2.2
Borax	1.0
Water	80.0

Melt the wax and diglycol oleate at 80°C., and make a solution of the other ingredients at same temperature. Add latter to former slowly while mixing vigorously with electric stirrer.

Paraffin Wax Emulsions

Formula No. 1[29]

a. Paraffin Wax	12
b. Stearic Acid	5
c. Trigamine	3
d. Water	80

Melt *a* and *b* at 65–70°C. and add *c* and *d* at same temperature, slowly, while mixing with a high-speed agitator.

Formula No. 2[30]

a. Paraffin Wax	120 g.
Stearic Acid	12 g.
b. Ammonia (26° Bé.)	6 cc.
Water	182 cc.

Melt *a* together and, while stirring vigorously, add *b* heated to 55°C. Stir until uniform.

Formula No. 3[31]

a. Glyceryl Monostearate	5
Water	150
b. Paraffin Wax (Melted)	40

Heat *a* and stir vigorously until uniform. Pour *b* into this slowly, while stirring strongly.

Formula No. 4[32]

a. Paraffin Wax	25
Glycol Stearate	5
b. Water (Boiling)	175

Melt *a* together and while stirring vigorously add *b*.

Formula No. 5[33]

Mix 33 parts of paraffin wax with 3 parts of olein, and pour this mixture into a solution of 0.6 part of strong ammonia in 63.4 parts of water, heated to 160°F.

Paraffin Wax ("Soluble")

Formula No. 1[34]

a.	Paraffin Wax	50
	Stearic Acid	14
b.	Trigamine	7

Melt *a* to about 70°C. Turn off the heat and add *b* stirring thoroughly. Continue stirring till it begins to solidify. One part of the above disperses easily in 2 parts of hot water.

Formula No. 2[35]

Paraffin Wax	77
Duponol WS	23

References

[1] Bennett, Chem. Formulary, Vol. 2, p. 182 (1933).
[2] Bennett, Chem. Formulary, Vol. 4, p. 96 (1939).
[3] Personal Communication.
[4] Personal Communication.
[5] Bennett, Chem. Formulary, Vol. 5, p. 72 (1941).
[6] Bennett, Chem. Formulary, Vol. 5, p. 72 (1941).
[7] Bennett, Chem. Formulary, Vol. 1, p. 162 (1933).
[8] Bennett, Chem. Formulary, Vol. 1, p. 162 (1933).
[9] Glyco Products Co., Inc., Brooklyn, N. Y. (Catalog).
[10] Bennett, Chem. Formulary, Vol. 4, p. 475 (1939).
[11] E. I. du Pont de Nemours and Co., Wilmington, Del.
[12] Steinle, U. S. 2,275,659 (1942).
[13] Amer. Gum. Importers' Assn.
[14] Bennett, Chem. Formulary, Vol. 5, p. 72 (1941).
[15] Bennett, Chem. Formulary, Vol. 4, p. 96 (1939).
[16] Bennett, Chem. Formulary, Vol. 1, p. 162 (1933).
[17] Bennett, Chem. Formulary, Vol. 1, p. 162 (1933).
[18] Bennett, Chem. Formulary, Vol. 1, p. 162 (1933).
[19] Bennett, Chem. Formulary, Vol. 1, p. 162 (1933).
[20] Bennett, Chem. Formulary, Vol. 4, p. 475 (1939).
[21] E. I. du Pont de Nemours & Co., Wilmington, Del.
[22] Bennett, Chem. Formulary, Vol. 4, p. 96 (1939).
[23] Personal Communication.
[24] Bennett, Chem. Formulary, Vol. 2, p. 175 (1935).
[25] Bennett, Chem. Formulary, Vol. 2, p. 182 (1935).
[26] Bennett, Chem. Formulary, Vol. 2, p. 189 (1935).
[27] Bennett, Chem. Formulary, Vol. 4, p. 96 (1939).
[28] Bennett, Chem. Formulary, Vol. 5, p. 72 (1941).
[29] Bennett, Chem. Formulary, Vol. 4, p. 96 (1939).

[30] Bennett, Chem. Formulary, Vol. 3, p. 108 (1936).
[31] Bennett, Chem. Formulary, Vol. 3, p. 108 (1936).
[32] Bennett, Chem. Formulary, Vol. 3, p. 108 (1936).
[33] Bennett, Chem. Formulary, Vol. 3, p. 108 (1936).
[34] Bennett, Chem. Formulary, Vol. 4, p. 475 (1939).
[35] E. I. du Pont de Nemours & Co., Wilmington, Del.

CHAPTER XXXIII

MISCELLANEOUS

Non-aqueous Emulsion[1]

Wool Grease	20
Benzol	50
Balata Solution (1 Lb. to 1 Gal.)	50
Methyl Acetone	50
Alcohol	25

High-temperature-stable Non-aqueous Emulsions

	Formula No. 1[2]	No. 2[3]
Mineral Oil	40	40
Calcium Glyceryl Stearate	5	..
	Formula No. 1	No. 2
Polyglycerol Soya Bean Ester	..	5
Glycerin	60	60

Heat to 200°C. and keep stirring while heating.

Safety-paper Ink[4]

An emulsion of a suitable printing ink consistency comprises 8–20 parts of Canadian balsam, 5–17 parts of turpentine, 8–25 parts of finely divided substantially colorless mineral matter such as diatomaceous silica and 12–30 parts of castor oil, emulsified with a slightly alkaline solution of borax, and contains a suitable indicator such as phenolphthalein, so that it is suitable for "safety paper" for checks, etc.

Non-foaming Oil Emulsion[5]

Stearic Acid	1 g.
Oil-Soluble Mahogany Sulfonate	99 g.
Mineral Oil	500 g.
Water	5000 cc.

Warm and mix first three ingredients until clear; then add water slowly with vigorous mixing.

Petroleum Demulsifiers

Formula No. 1[6]

Diglycol Laurate	83
Sodium Silicate	5
Rosin Soap	5
Phenol	4
Water	1½
Paraffin Wax	1½

Formula No. 2[7]

Furfuraldehyde-Potassium Bisulfite Solution	11.1
Ricinoleic Acid	50.4
Ammonia (Sp. Gr. 0.897)	8.9
Castor Oil	29.6

Formula No. 3[8]

The oil is mixed with

Caustic Soda	25
Sodium Acetate	10
Alcohol	20
Glycerin	10
Water	35–45

Dichloroethyl Ether Emulsion Spray[9]

(Cabbage-Maggot Spray)

Dichloroethyl Ether	20 cc.
Tergitol F	0.4 cc.
Water	To make 1 gal.

Benzyl Benzoate Emulsion[10]

Benzyl Benzoate	250 cc.
Triethanolamine	10 g.
Stearic Acid	50 g.
Distilled Water	To make 1000 cc.

Dissolve the stearic acid in the benzyl benzoate with the aid of gentle heat; add the solution to a mixture of the triethanolamine and 500 cc. of water, previously warmed to the same temperature. Shake until emulsified and then add sufficient water to make the required volume.

Carbon Disulfide Emulsion[11]

Rosin Fish-oil Soap	1
Water	3
Carbon Disulfide	10

Place the soap and water in a bottle and shake until the solution is uniform. Then add the carbon disulfide and shake for 1 or 2 minutes or until a creamy emulsion has formed.

Methyl Salicylate Emulsion

Methyl Salicylate	25
Sulfonated Castor Oil	10
Water	65

REFERENCES

[1] Simon, U. S. 1,657,323 (1928).
[2] Personal Communication.
[3] Personal Communication.

[4] Bennett, Chem. Formulary, Vol. 4, p. 147 (1939).
[5] U. S. 2,052,164.
[6] Bennett, Chem. Formulary, Vol. 3, p. 114 (1936).
[7] Bennett, Chem. Formulary, Vol. 4, p. 99 (1939).
[8] Bennett, Chem. Formulary, Vol. 4, p. 99 (1939).
[9] Bennett, Chem. Formulary, Vol. 7, p. 111 (1945).
[10] Bennett, Chem. Formulary, Vol. 7, p. 111 (1945).
[11] Bennett, Chem. Formulary, Vol. 7, p. 121 (1945).

CHAPTER XXXIV

DISPERSIONS

Dispersions of Insoluble Powders[1]

INSOLUBLE powders such as zinc oxide, sulfur, Neozone D, Zenite, dry powder colors, and fillers are dispersed by grinding in water with a protective colloid and a dispersing agent. The presence of a small amount of fixed alkali in such a mixture is desirable.

Insoluble Powder	100.00
Casein	3.00
Preservative Moldex	0.25
Darvan (Dispersing Agent)	1.00
Sodium Hydroxide	0.10
Water	95.65
Ammonia Solution (29%)	1.00

Heat the water to 175°F. and add the ammonia solution. Add slowly with rapid stirring the casein and continue stirring until it is dissolved. Then add the sodium hydroxide. Next the preservative should be added. Darvan is readily soluble in water and may be added to the solution alone or with the insoluble powders, which are next added. The mixture is then placed in a pebble mill having a capacity double the volume of the mixture and ground for about 24 hours or ground in a colloid mill for a suitable length of time. If dry color pigments are being dispersed, it is desirable to double the grinding time.

Carbon Black Dispersion[2]

Carbon Black	100
Darvan	4–8
Water	563–599

If a thicker dispersion than results from the above is desired, it may be obtained by adding during the last hour of grinding 1–2 parts of casein in water solution.

The method used is similar to that for suspending insoluble powders.

Carbon Black Dispersant[3]

Quebracho Powder (Finely Ground)	95.0
Soda Ash	5.0
Phenol	0.2

Mix and grind in a pebble mill.

Dispersing Agents

Formula No. 1[4]

Tallow	175
Dimethyl Amine (25%)	324

Heat at 200°C. in an autoclave for 16 hours. This yields a mixture of dimethyl amides.

Formula No. 2[5]

a. Lauryl Alcohol, Melted	186
Chlorsulfonic Acid	116
b. Triethanolamine	150

Stir *a* while heating gently.

After removing the hydrogen chloride by passing through the reaction mixture current of inert gas, add *b*.

Formula No. 3[6]

Three hundred and twenty-five kg. of octadecenylamine are sulfonated at 25°C. with 400 kg. of concentrated sulfuric acid. After the product has become water-soluble, it is pressed on to ice, washed with saturated Glauber's salt solution in order to remove the excess of sulfuric acid and finally neutralized with caustic soda solution.

Formula No. 4[7]

Sulfonated Castor Oil	35
Steam-distilled Pine Oil	35
Water	30

Heat the castor or red oil, agitate while adding the pine oil until thoroughly blended; add water, then add a 25% solution of caustic soda solution with stirring until the solution becomes clear. Ten cc. in 50 or 100 cc. of cold water should dissolve instantly and no separation should occur.

Formula No. 5[8]

Water	50
Caustic Soda	16
Sulfonated Castor Oil (75%) or Red Oil	6– 8
Cresylic Acid	25–32

Add caustic to water; then add castor or red oil, while stirring until solution clears. The cresylic acid is best added before the oil.

REFERENCES

[1] Bennett, Chem. Formulary, Vol. 5, p. 73 (1941).
[2] Bennett, Chem. Formulary, Vol. 5, p. 73 (1941).
[3] Bennett, Chem. Formulary, Vol. 5, p. 73 (1941).
[4] Bennett, Chem. Formulary, Vol. 4, p. 99 (1939).
[5] Bennett, Chem. Formulary, Vol. 4, p. 99 (1939).
[6] Bennett, Chem. Formulary, Vol. 2, p. 184 (1935).
[7] Personal Communication.
[8] Personal Communication.

INDEX

A

Abrasive polish, 504
Absorption base, 340
— base creams, 207
Acacia gum. See Gum acacia.
Acetate rayon oil, 531
— rayon waterproofing emulsions, 532
Acid cosmetic creams, 333
— skin milk, 318
— soaps, 15
Acriflavine emulsion, 349
Agar, 10
—, combination with gum acacia, 10
— emulsions, influence of calcium on the stability of, 47
Agents, emulsifying, 9, 53
—, emulsifying, for cosmetic emulsions, 65
Agricultural sprays, 60, 257
Air deodorizer, 362
—, influence of, on the stability of emulsions, 50
Air-odor neutralizer, 362
Alkali soaps, 15
All-purpose creams, 210, 311
Almond cream, 334
— cream, liquid, 336
— oil emulsions, 318
— oil emulsions, bitter, 375
Alphabetical list of commercial surface-active agents, 79
— list of defoaming agents, 161
— list of demulsifying agents, 161
— list of emulsifying agents, 85
— list of emulsions, 114
— list of oil emulsions, 123
— list of surface-active agents, 79
Aluminum hydroxide, 16
— stearate in defoaming compounds, 367
American method of manufacture of emulsions, 29
Amines, synthesis of, 59
Analytical procedures, defoaming in, 367
Anionic agents, 77, 194
Anti-corrosive spindle lubricant, 405
Anti-foaming agent for radiators, 368
Antifoams, 23
Anti-knock fuel, 385
Antiseptic creams, 348
— emulsions, 362
— liquid, 418
— oil, water-dispersible, 418
Anti-static textile dressing, 525
Aridye process, 225
Artificial cream, 371
Asphalt emulsions, 61, 114, 291
— emulsions, defoaming of, 367
— emulsions, defoaming of, with octyl alcohol, 24
— emulsions, lecithin in, 172
— emulsions with bentonite, 62
— rosin emulsions, 512
Astringent creams, 335
Automobile polish emulsions, 72
— polishes, 437
— radiator cleaner, 302
Avocado oil cleansing cream, 336
— oil cream, 335
— tissue cream, 335

B

Bacterial hydrogenation, 59
Baking industry, emulsions in, 236
— industry, use of glyceryl monolaurate in, 237
— industry, use of glyceryl monostearate in, 237
— industry, use of lecithin in, 169

Barium stearate in defoaming compounds, 368
Bartlett-Snow triple-action colloid mill, 35
Bath milk, 318
— oil, 318
Beauty milk, 317
Beeswax borax emulsions, 50
— emulsions, 116
Beet sugar solutions, defoaming of, 24, 367
Belt preservative, non-slippery, 530
Bentonite, 16, 17, 27
— asphalt emulsions, 62
— wax emulsions, 537
Benzene emulsions, 6, 48, 116
— emulsions, addition of lauric acid to, 15
Benzyl benzoate emulsion, 552
Bile, 10
Bitter almond oil emulsions, 375
Bituminous emulsions, 61, 117, 291, 294
— emulsions, soap in, 188
Black bottom gloss, 475
Black-pigmented lacquer emulsions, 394
Bleaching creams, 337
Borneol emulsions, 118
Boroglycerin lanolin cream, 336
Bottom cream, brown, 481
— finish, brown, 478
— gloss, black, 475
— gloss, brown, 481
— ink, 482
— stain for "natural leather," 478
Breaking of emulsions, 55
— of paint emulsions, 71
Bright-drying floor polish emulsions, 452
Bronzing, removing of, 225
Brown bottom cream, 481
— bottom finish, 478
— bottom gloss, 476
— heel stain, 477
— russet finish, 478
— russet stain, 479
Brushless shaving creams, 213
Buna N, 244
Buna S, 244
Burn emulsions, 351
— ointments, 406
Burnishing ink, 485
Butadiene emulsions, 118
Butter, lecithin in, 170
— substitute, 375
Butterscotch icing, 370

C

Cabbage maggot spray, 552
Calcium carbonate, 16
— chloride, influence on asphalt emulsions, 64
—, influence on the stability of various emulsions, 47
— lignin sulfonate, 19
— oleate in defoaming compounds, 368
— salts, influence on phase reversal, 5
— xylene sulfonate, 19
Camphor emulsions, 118
Candelilla wax emulsions, 538
Carbohydrates, 10, 11
Carbon, 16
— bisulfide emulsions, 119
— black, 16
— black dispersant, 555
— black dispersion, 554
— disulfide emulsions, 552
—, stabilizing action of, 49
— tetrachloride emulsions, 61, 119
Carnauba wax emulsions, 119, 539
— wax resin emulsions, 541
Castor oil emulsions, 6, 124, 416
— oil soap, 15
Cationic agents, 77, 194
Causes of instability of emulsions, 51
Cellulose emulsions, 514
— ester emulsions, 517
Cephalin, 168
Ceresin wax emulsions, 542
Cheese stabilizer, 372
Chemical activity of emulsions, 59
Chewing gum, lecithin in, 171
Chlorinated rubber emulsions, 521
Chlorobutadiene emulsions, 119
Chocolate, lecithin in, 173
— milk, stabilized, 370

Cholesterol, 11
— lecithin creams, 337
Chromium plate cleaners, 303
Cleaner, automobile radiator, 302
—, chromium plate, 303
—, graphite, 303
—, greasy leather, 304
—, leather, 304
—, metal, 304
—, paint, 305
—, painted woodwork, 305
—, printing rolls, 308
—, rubber rug, 309
—, rug, 306
—, upholstery, 307
—, wooden surface, 308
Cleaners, 298
Cleansers. See Cleaners.
Cleansing creams, 319
—, creams, liquid, 220
Clinical application of surface-active agents, 198
Coal-tar emulsions, 124
Coating, fruit, 268
—, paper, 242
— for aluminum, protective, 496
— for glass fibers, 531
— for metals, protective, 496
Coatings, emulsifiable, 59
Cocoa icing, 370
— powder, lecithin in, 170
Coconut oil emulsions, 124
— soap, 15
Cod liver oil emulsions, 124, 406
— liver oil emulsions and phase reversal, 5
— liver oil emulsions with pectin, 178
Cold creams, 204, 323
"Cold roller grease briquets," 403
Colloid mill, Bartlett-Snow triple-action, 35
— mill, Manton-Gaulin, 36, 37
Colloid mills, 33
Colloidal hydroxides, 16
Commercial surface-active agents, alphabetical list of, 79
Comparison of the emulsifying effect of soap emulsifiers, 15
— of the emulsifying effect of various soaps, 15
Comparison of the foaming power of various foaming agents, 23
Compound emulsifying agents, 286
Constituents of emulsions, influence on stability, 47
Continental method of emulsion manufacture, 29
— process, pectin in the, 174, 176
Continuous phase. See External phase.
Cosmetic creams, 241, 311, 325
— emulsions, 65, 202, 311
— lotions, 241
— products, soap in, 191
Cottonseed oil emulsions, 125
Cream, synthetic, 371
Creaming, 45
— of latex emulsion, 70
— of pectin emulsions, 176, 177
Creams, 65
—, cosmetic, 241, 311, 325
—, frost-bite preventive, 411
—, lecithin in, 171
—, soap in, 191
Creosote oil emulsions, 125
Cresylic acid containing emulsions, 60
Cumar emulsions, 513
Cutting oils, 66, 272
— oils, soap in, 189
Cyclohexanol emulsions, 120

D

Dairy product stabilizer, 372
Decomposition of emulsions, 51
De-emulsification, 55
De-emulsifiers for petroleum, 551
Definition of emulsions, 3
Defoaming action of octyl alcohol, 23
— agents, 23, 367
— agents, alphabetical list of, 161
Defrothing agents, 367
Degreasing emulsions, 526
Deinking printed paper, 436
Delustering of rayon, 532
Demulsifying agents, alphabetical list of, 161
Deodorant creams, 216, 332

Deodorizer for air, 362
Deodorizing creams. See Deodorant creams.
Detergent emulsions, 67
Determination of globule size, 46
— of particle size, 46
Dichloroethyl ether emulsion spray, 552
Diethylene glycol monolaurate, 204
Diglycol laurate S, 204
Diglycol stearate S, 203
Discontinuous phase. See Internal phase.
Disinfectant emulsions, 358, 420
— with pine oil, 360
Dispersant for carbon black, 555
Dispersed phase. See Internal phase.
Dispersing agents, 76, 555
Dispersion, excessive, 52
—, insufficient, 52
Dispersions, 554
Double-propeller mixer, 32
Downward creaming, 45
Draves-Clarkson method for evaluation of wetting agents, 77
Drug emulsions, 311
Dry cleaners' soap, 298
Drying oil emulsions, 59, 125
Dual emulsifying agents, 4
Dual emulsions, 3, 6, 7
— emulsions, influence of lecithin on the formation of, 7, 13
— emulsions, influence of proteins on the formation of, 7
Dye emulsions, 223

E

Edge filler for shoes, 400
— finish, transparent, 477
— ink, 482
— stain, brown, 477
Egg white foam, 22
— yolk, 11
— yolk containing emulsions, 68
— yolk for fat-liquoring, 250
Electrolytes, influence on stability of emulsions, 51, 52
Emulsification, method of, 3
Emulsifiers. See Emulsifying agents.
— for insecticides, 267
—, influence on phase reversal, 5
—, influence on stability, 47
Emulsifying agents, 9, 286
— agents, alphabetical list of, 85
— agents, compounds of, 286
— agents, dual, 4
— agents for cosmetic emulsions, 65, 202
— agents for emulsion paints, 231
— agents for oil-in-water emulsions, 5
— agents for water-in-oil emulsions, 5
— agents, hydrophilic, 4
— agents, hydrophobic, 4
— agents, influence on stability of emulsions, 53
— agents, papers on, 167
— agents, role of, 3
— effect of various soaps, 186
Emulsion paints, 228, 229
— paints, emulsifying agents for, 231
— paints formulae, 233
— paints, preparation of, 232
— paints, stabilizing material in, 231
— paints, vehicle in, 230
— paints vehicle, preparation of, 232
— solvent soap, 300
Emulsions, alphabetical list of, 114
Equipment, 29
English process, pectin in the, 176
Errors in making creams, 65
Esparto wax emulsions, 543
Essential oil emulsions, 125
Ethyl cellulose emulsions, 514
Evaluation of wetting agents, 77
Excessive dispersion, influence on stability, 52
External phase, 3, 5
— phase, influence on stability, 46

F

Fat emulsions, various, 121
Fat-liquoring, 249
— compositions, soap in, 190
Fat-liquors, 70, 396
Ferric hydroxide, 16

Film-forming properties, 42
Finish for yarn, 528
Finishes, 240
Finishing, leather, 251
Floor polish emulsions, 72
— polishes, 449
— wax, 240
Foam breakers, various, 24
— producer, 23
— value of senega root, 21
Foamex, 367
Foaming power, comparison of various foaming agents, 23
Foamipin, 23
Foams, 21
Food emulsions, 68, 236, 370
Formulation of emulsions, 28
Foundation creams, 210
Freckle "preventive," 333
Freezing, influence of, on stability of emulsions, 50
Frost-bite preventive creams, 411
Frothing, 21
Fruit coating wax emulsions, 243, 268
— tree sprays, 259
Fulling oil, soapy, 527
Fungicidal sprays, 60
Fur glaze, 504
Furniture polishes, 72, 458

G

Gas, influence of, on stability of emulsions, 50
Gasoline emulsions, 17, 121, 381
—, solidified, 385
Gaulin laboratory homogenizer, 40
Gelatin, 11
— emulsions, influence of pH on, 12, 47
— emulsions, viscosity of, 44
Gelva resin emulsions, 513
Gensa process, 225
Germicidal activity of surface-active agents, 195
Germicides, surface-active agents as, 193
Gilsonite emulsions, 121
Glass fibers, coating for, 531
— polish, 504
Glaurin, 204
Glaze for furs, 504
Globule size, determination of, 46
Gloss ink, 486
Glue, defrothing of, 367
Glycerin and lime cream, 339
—, stabilizing action of, 48
Glyceryl esters, 180, 183
— laurate S, 183
— monolaurate, 183
— monolaurate in the baking industry, 237
— monoricinoleate, 184
— monoricinoleate S, 184
— monostearate, 184, 202
— monostearate creams, 205
— monostearate in the baking industry, 237
— monostearate S, 203
Graphite cleaner, 303
— lubricant, 404
Gray-pigmented lacquer emulsions, 395
Grease for horse-shoes, 403
—, mixed-base, 403
Greaseless creams, 208
Greasy leather cleaner, 304
Gum acacia, 9, 10, 27
— acacia, combination with agar, 10
— acacia, combination with gum tragacanth, 10
— acacia, combination with pectin, 13
— acacia, comparison with pectin, 177
— acacia emulsions, influence of pH on, 49
— acacia, influence on phase reversal, 5
— acacia, stabilizing action of, 48, 49
— emulsions, various, 121
— tragacanth, combination with gum acacia, 10
— tragacanth emulsions, influence of pH on, 49
— tragacanth, influence on phase reversal, 5

H

Hair creams, 351
— milk, 353

Hair tonic, 354
— wash, milky, 353
Halowax emulsions, 543
Hand creams, 211, 345
Hard water, use of polyhydric alcohol esters with, 14
Hay fever ointment, 419
Heat, influence of, on stability of emulsions, 50
Heavy ink for spongy leathers, 485
Heel finish, transparent, 477
— ink, 482
— stain, brown, 477
High-melting materials, 28
Homogenizers, 39
Homogenizer, Gaulin laboratory, 40
Honey and almond cream, 334
— creams, 334
Hormone cream, 338
Horsepower required for mixing, 33
Horse-shoe grease, 403
Hydrocarbon emulsions, 121
Hydrogenation, bacterial, 59
Hydrophilic components, 194
— emulsifying agent, 4
Hydrophobic emulsifying agent, 4
Hydrotropic solvents, 19
Hydroxides of metals, 16

I

Icecream, 238
— stabilizer, 372
— with lecithin, 169
Icing, butterscotch, 370
—, cocoa, 370
Incompatibilities of cationic agents, 199
— of pectin emulsions, 176
— of pectin ointments, 180
Incompatibility of ingredients, influence on stability of the emulsion, 52
Industrial protective creams, 212
Infants' milk, synthetic, 373
Ink cleaner, 303
— for bottoms, 482
— for edges, 482
— for heels, 482
— for shoes, 477
Ink, polishing, 483
—, safety paper, 550
Inks, 226
—, lecithin in, 173
Insecticide preparations, lecithin in, 172
— sprays, 262
—, emulsifiers for, 267
—, soap in, 190
—, spreaders for, 267
Instability, causes of, 51
— of emulsion due to insufficient viscosity, 53
— of emulsions due to electrolytes, 52
— of emulsions due to excessive dispersion, 52
— of emulsions due to failure to distinguish type of emulsion, 53
— of emulsions due to improper emulsifying agents, 53
— of emulsions due to improper procedure, 53
— of emulsions due to improper storage, 53
— of emulsions due to incompatibility of ingredients, 52
— of emulsions due to insufficient dispersion, 52
— of emulsions due to temperature, 52
Insufficient dispersion, influence on stability of emulsions, 52
— viscosity, influence on stability of emulsions, 53
Interfacial film, 9, 42
— tension, influence of wetting agents on, 76
Internal phase, 3
— phase, influence on stability, 45
Intermittent shaking, influence of, 29
Inversion. See Phase reversal.
— of olive oil emulsions, 5
Irish moss emulsions, 48, 49
Iron dust, 16
Irregularities in viscosity, 44
Isocholesterol, 11
Isoprene emulsions, 122

J

Japan wax emulsions, 544

K

Kerosene emulsions, 17, 60, 122
— emulsions, influence of sodium sulfate on, 47
— emulsions, soaps in, 186
Kier penetrant oil, 526

L

Laboratory homogenizer, Gaulin, 40
Lacquer base formulae, 388
— emulsifiers, 389
— emulsions, 69, 388
— remover for hands, 304
Lampblack, 16
Lanolin, 11
— cream with boroglycerin, 336
— emulsions, 319
Latex dipping, 227
— emulsions, 70
Laundry wax, self-emulsifying, 544
Lauric acid in benzene emulsions, 15
Lead arsenate containing emulsions, 61
— hydroxide, 16
Leather cleaner, 304
— dressings, 397
— emulsions, 70
— finishing, 241, 251, 398
— finishing composition, 253
— industry, lecithin in, 172
— ink, 485
— manufacture, 247
— polishes, 398, 463
— processing, soap in, 190
— softener, 400
— treatment emulsions, 396
— waterproofing emulsions, 536
Lecithin, 12
— as emulsifying agent, 167
— emulsions, influence of calcium on the stability of, 47
—, formation of dual emulsions, 7, 13
— in asphalt emulsions, 172
— in butter, 170
— in chewing gum, 171
— in chocolate, 173
— in cocoa powder, 170
— in creams, 171
Lecithin in icecream, 169
— in ink, 173
— in insecticide preparations, 172
— in margarine, 170
— in plastic compositions, 171
— in shaving creams, 170
— in shoe polishes, 172
— in soap, 170
— in tanning preparations, 172
— in tar emulsions, 172
— in the baking industry, 169
— in the leather industry, 172
— in the paint industry, 171
— in wax polishes, 171
Lemon oil emulsions, 373
— oil emulsions, transparent, 374
Licorice root, 23
Lime and glycerin cream, 339
— water and olive oil emulsions, 6
Liniments, 414
Linseed oil emulsions, 126
Lip make-up, liquid, 339
Lipophilic components, 194
Liquid creams, 218
— stockings, 222
List of emulsions alphabetically arranged according to special ingredients, 114
— of foam breakers, 24
— of polyhydric alcohol esters, 13
— of polyhydric ether esters, 13
Lubricant emulsions, 402
— grease, 402
— for textiles, 531
Lubricants, soap in, 189
Lubricating emulsions with soap-base, 404
Luster emulsion for starching, 526

M

Mahogany sulfonates, 18
Manton-Gaulin colloid mill, 36
Margarine, lecithin in, 170
Mascara, 221, 339
Massage cream, 346
Mayonnaise, 68, 376
Mechanical methods of foam breaking, 24
Medical application of surface-active agents, 198

Medicated creams, 214
Medicinal emulsions, 71, 406
Mercuric nitrate ointment, 418
Metal cleaner, 304
— drawing compounds, 282
— polishes, 489
Metallic soaps, 15
Methanol emulsions, 6
Methods of making emulsions, 26
Methyl methacrylate emulsions, 515
— salicylate emulsions, 552
Mildew spray, 259
Milk, synthetic, for infants, 373
Milky hair wash, 353
Mineral oil emulsions, 27, 127, 411
— oil emulsions, influence of pH on, 49
— oil emulsions with pectin, 177
Miscible oils, 272
— oils, naphthenic, 284
— "soluble" oils, 66
Mixed-base grease, 403
Mixer speed, 30
— with one propeller, 31
— with two propellers, 32
Mixers, 30
Monostearin, 202
Montan wax emulsions, 544
Mosquito-repelling creams, 347
Mothproofing emulsions, 532
Moustache pomade, 340

N

Nail cream, 347
Naphthalene emulsions, 123
Naphthenic acid soaps, 15
— miscible oils, 284
Natural bottom finish, 476
— leather bottom stain, 478
— leather finish, 480
— resin emulsions, 516
— rubber, 243
Neatsfoot oil emulsions, 130
— oil polish, 504
Nicotine emulsions, 61, 123
Nitration of *p*-cymene, 59
Nitrocellulose emulsions, 123, 388
Non-aqueous emulsions, 550
Non-dispersible surface-active agents, 181
Non-foaming oil emulsions, 551
— surface-active agents, 180, 195
Non-slippery belt preservative, 530
— rope preservative, 530
Nourishing creams, 340

O

Octane emulsions, 48
Octyl alcohol as defoaming agent, 23, 367
— alcohol as wetting agent, 78
Oil coating for glass fibers, 531
—, defoaming of, with octyl alcohol, 24
— emulsions, alphabetical list of, 123
— emulsions, non-foaming, 551
— polish, 504
— separation of pectin emulsions, 176
Oil-in-water and water-in-oil emulsions, 3
— emulsions, 26
— emulsions, emulsifying agents for, 5
Oils, cutting, 66, 272
— miscible, 272
— naphthenic miscible, 284
—, "soluble," 272
Oil-soluble emulsifying agent. See Hydrophobic emulsifying agent.
Ointments, 71
— with pectin, 179
Oleates, stabilizing action of, 48
Oleic acid in defoaming compounds, 368
Olive oil and lime water emulsions, 6
— oil emulsions, 6, 130
— oil emulsions, inversion of, 5
— oil emulsions, soap in, 186
Opal wax emulsions, 545
Orange oil emulsions, 374
Ouricouri wax emulsions, 546

P

Paint cleaner, 305
— emulsions (see also Emulsion paints), 71, 422
— industry, lecithin in, 171
Painted woodwork cleaner, 305
Paints, semi-paste, 428
Palm oil emulsions, 131
Paper processing emulsions, 431

Paper sizings, 431
—, waterproofing emulsions for, 433
Papermaking, defoaming with octyl alcohol, 24
Papers on emulsifying agents, 167
Paraffin emulsions, soap in, 189
— oil emulsions, 6, 131
— rosin emulsions, 512
— wax emulsions, 132, 547
Partial glyceryl esters, 180
Particle size, determination of, 46
— size, influence on creaming, 46
— size, influence on stability, 46
Peanut oil emulsions, 131
Pectin, 13
— as emulsifier, 174
—, combination with gum acacia, 13
—, comparison with gum acacia, 177
— emulsions, 176
— emulsions, creaming of, 176, 177
— emulsions, incompatibilities of, 176
— emulsions, oil separation of, 176
— emulsions, preparation of, 174, 176
— emulsions with cod liver oil, 178
— emulsions with mineral oil, 177
— in the Continental process, 174, 176
— in the English process, 176
— ointments, 179
— ointments, incompatibilities of, 180
Pentaerythritol abietate emulsions, 513
Perfumes, solidified, 356
—, water-soluble, 356
Permanent wave cream, 221
Peroxide cream, 337
Perspiration-deodorizing creams, 332
Petrolatum emulsions, 133
— emulsions, liquid, 362
Petroleum cracking, 59
— demulsifiers, 551
— emulsions, 27, 134
— emulsions, increase of viscosity of, 44
pH, influence on asphalt emulsions, 62
—, influence on gelatin emulsions, 12
—, influence on stability of emulsions, 47
—, influence on stability of mineral oil and vegetable oil emulsions, 49
Phase reversal, 4, 5, 6
— reversal, influence of calcium salts on, 5
— reversal, influence of emulsifiers on, 5
— reversal, influence of gum acacia on, 5
— reversal, influence of gum tragacanth on, 5
— reversal, influence of sodium chloride on, 5
— reversal, influence of zinc salts on, 5
Phase-volume ratio, 45
Piccolyte oil emulsion, semi-paste, 429
— oil emulsions, 428
Pine oil disinfectant, 360
— oil emulsions, 354, 360
— oil in defoaming compounds, 367
— oil soap, 299
Pink bottom finish, 476
Pitch emulsions, 134, 296
Plant protectant sprays, soap in, 190
Plaster of Paris, 16
Plastic compositions, lecithin in, 171
Polar-non-polar compounds, 77
Polish emulsions, 72, 437
— for glass, 504
— powder, 503
Polishes for automobiles, 437
— for floors, 449
Polishes for furniture, 458
— for leather, 463
— for metals, 487
— for stoves, 497
—, soap in, 190
Polishing emulsions, 500
— ink, 483
Polyhydric alcohol compounds, 180
— alcohol esters, 13
— alcohol esters, use with hard water, 14
— ether esters, 13
Polymerization, 59
Polystyrene resin emulsions, 518
Premier colloid mill, 36, 38
Preparation of emulsion paints, 232
— of emulsion-paint vehicle, 232
— of emulsions, 4
— of pectin emulsions, 174, 176

Printing inks, 226
— roll cleaner, 308
Procedure, influence on stability of emulsions, 53
Protective coating for aluminum, 496
— coating for metals, 496
— hand creams, 345
Proteins, influence on the formation of dual emulsions, 7
Psoriasis lotion, 419
Pyrethrum emulsions, 61, 134

Q

Quick black, 483

R

Radiator anti-foaming agent, 368
— cleaner, 302
Rayon delustering, 532
— oil, 531
— waterproofing emulsions, 532
Removal of bronzing, 225
Resin emulsion paint, 230
— emulsions, 225, 510, 541
— oil emulsion, 427
Reversal, phase, 4, 5, 6
Rope preservative, non-slippery, 530
— preservatives, 530, 531
Rosin asphalt emulsions, 512
— emulsions, 136, 510
— paraffin emulsions, 512
— turpentine emulsions, 511
Rotproofing emulsions, 526
Rubber emulsions, 136, 519
— latex, 243
— latex emulsions, 70
— manufacture, use of soap in, 188
— resin emulsions, 520
— rug cleaner, 309
Rubless floor polish emulsions, 452
Rug cleaner, 306

S

Saddle soap, 307
Safety-paper ink, 550
Salad dressing stabilizer, 372
Salad dressings, 378
Saponin, 21
— emulsions, influence of calcium on, 47
Self-emulsifying laundry wax, 544
Semi-paste paints, 428
— piccolyte oil emulsion, 429
Shampoo, soapless, 354
Shaving creams, 356
— creams, lecithin in, 170
Sheep dips, 269
Shelf testing, 28
Sher-dye process, 225
Shoe creams, 242
— ink, 477
— polish emulsions, 72
— polishes, lecithin in, 172
— polishes, white, 486
Single propeller mixer, 31
Sizing emulsions, 225
— for paper, 431
— for textiles, 523
Skin lotions, 312
— milk, acid, 318
Soap, 185
— base lubricating emulsions, 404
— in bituminous emulsions, 188
— in cosmetic products, 191
— in creams, 191
— in cutting oils, 189
— in fat-liquoring compositions, 190
— foam, 23
— in insecticides, 190
— in leather processing, 190
— in lubricants, 189
— in paraffin emulsions, 189
— in plant protectant sprays, 190
— in polishes, 190
— in rubber manufacture, 188
— in wax emulsions, 189
—, lecithin in, 170
— paste paint cleaner, 305
—, saddle, 307
Soapless shampoo, 354
Soaps, 14, 298
—, comparison of their emulsifying effect, 15
—, emulsion solvent, 300
—, dry cleaner's, 298

Soapy fulling oil, 527
Sodium cetyl sulfate, 18
— chloride, influence on phase reversal, 5
— kerosene sulfonate, 19
— lauryl sulfate, 18
— oleate soap, 15
— palmitate, 15
— stearate, 15
— sulfate, influence of, on kerosene emulsions, 47
Softeners for leather goods, 400
— for textiles, 527
Solid emulsifiers, 16
Solidified gasoline, 385
"Soluble," miscible oils, 66
— oils, 272
— paraffin wax emulsions, 548
— textile oils, 528
Solvent soaps, emulsion of, 300
Sound-absorbing composition, 386
Special ingredients containing emulsions, alphabetically arranged, 114
Speed of mixing, 29
Spinning oil for light fibers, 530
Spongy leather ink, 485
Sports cream, 346
Spray emulsions, agricultural, 60
— with dichloroethyl ether, 552
Sprays, agricultural, 257
—, insecticidal, 262
Spreaders for insecticides, 267
Stability of emulsions, 42
— of emulsions, influence of air on, 50
— of emulsions, influence of electrolytes on, 51
— of emulsions, influence of gas on, 50
— of emulsions, influence of temperature on, 50
— of foam, 22
—, testing of, 54
Stabilization of various emulsions, 48
Stabilizer for food products, 372
Stabilizers. See Stabilizing agents.
Stabilizing action of glycerin, 48
— action of gum acacia, 48, 49
Stabilizing action of oleates, 48
— agents, 3
— agents in emulsion paints, 231
Starching emulsions, 526
Staybelite ester emulsions, 513
Stearic acid emulsions, 138
Stokes formula, 43
Storage, influence on stability, 53
Stove polishes, 497
Stuffing of leather, 247
Sulfanilamide emulsions, 419
Sulfated emulsifiers, 17
Sulfathiazole creams, 215
Sulfonated castor oil, 17
— emulsifiers, 17
— hydrogenated castor oil, 17
— olive oil, 18
Sulfur emulsions, 138
Sunburn healing preparation, 350
— preventive preparation, 349
Surface tension, influence on, of wetting agents, 76
Surface-active agents, 180, 187, 193
— agents, alphabetical list of, 79
— agents, clinical application of, 198
— agents, germicidal action of, 195
— agents as germicides, 193
— agents, incompatibilities with, 199
Synthetic cream, 371
— infants' milk, 373
—rubber latex, 243

T

Tanning preparation, lecithin in, 172
Tar asphalt emulsion, 296
— emulsions, 49, 138
— emulsions, lecithin in, 172
— oil containing emulsions, 60
Technical emulsions, 59
Temperature, influence of, on stability of emulsions, 50, 52
Test for type of emulsion, 3
Testing of wetting agents, 77
— stability, 54
Textile dressing, 525
— emulsions, 523, 534
— gloss oil, 527
— lubricants, 531
— oils, "soluble," 528

Textile scouring assistant, 526
— scouring emulsions, 530
— sizings, 523
— softeners, 527
— waterproofing emulsions, 534
Toluene emulsions, 48, 139
Tragacanth emulsions, influence of pH on, 47
Transparent edge finish, 477
— emulsions, 73
— heel finish, 477
— lemon oil emulsions, 374
Tree sprays, 259
Triethanolamine soaps, 16
Triple-action colloid mill, 35
Turpentine emulsions, 139
— rosin emulsions, 511
Type of emulsion, influence on stability, 53
— of emulsion, test for, 3, 4
Types of emulsions, 3
Typographic inks, 227

U

Upholstery cleaner, 307
Upward creaming, 45
Ultrasonic waves, 27
— waves, influence on viscosity of gelatin emulsions, 44

V

Vanishing creams, 208
Varnish emulsions, 140
— inks, defoaming of, 367
— inks, defoaming of, with octyl alcohol, 24
Vegetable oil emulsions, influence of pH on, 49
Vehicles in emulsion paints, 230
— in emulsion paints, preparation of, 232
Vinylite emulsions, 518
Vitamin emulsions, 140
Viscosity, influence of ultrasonic waves on, 44
—, influence on emulsions, 43
—, influence on stability of emulsions, 53
Viscosity of gelatin emulsions, 44
Viscous emulsion lubricant, 404

W

Washing compound, 308
Water-dispersible antiseptic oil, 418
Water-in-oil emulsion lubricant, 404
— emulsions, emulsifying agents for, 5
— emulsions, oil-in-water and, 3
Waterproofing emulsions for leather, 536
— emulsions for paper, 433
— emulsions for rayon, 532
— emulsions for textiles, 534
Water-repellent fabric, 241
Water-soluble perfumes, 356
Wax emulsions, 26, 73, 140, 239, 437, 537, 541
— emulsions for fruit coating, 268
— emulsions, soap in, 189
— polishes, lecithin in, 171
— russet finish, 479
Weed killers, 61
Wetting agents, 76
— agents, evaluation of, 77
— agents in emulsion paints, 231
Whey foams, 23
White bottom cream, 480
— bottom gloss, 480
— oil emulsion, 349
— shoe polishes, 486
— spirit emulsions and phase reversal, 6
Wooden-surface cleaner, 308
Woodwork cleaner, 305

X

Xylene emulsions, 48, 140

Y

Yarn finish, 528
Yeast, 16

Z

Zinc dust, 16
— hydroxide, 16
— salts, influence on phase reversal, 5

This book is issued for
7 DAYS ONLY.